HITACHI PERSONAL COMPUTER

MB-S1 10/20

OPERATIONAL MANUAL

This manual is a translation of the manual for Personal computer MB-S1 10/20 for use in Japan.
Some of the specifications may be changed in export models.

READ THIS MANUAL AFTER YOU HAVE OPENED THE PACKING BOXES CONTAINING YOUR MB-S1 SERIES PERSONAL COMPUTER. YOU'LL FIND ALL THE INFORMATION NEEDED FOR OPERATING THE HARDWARE.

For your information

1. Unauthorized copying of the contents of this manual, either in whole or in part, is prohibited.
2. The contents of this manual may be changed without notice.
3. Everything has been done to make this manual as accurate and complete as possible. If you find any sections that you cannot understand or if you find any errors please tell us about them.
4. We are not responsible for any user errors in operation.
5. The actual external appearance of your machine may differ slightly from what is shown in the photographs and drawings used in this manual.

CONTENTS

Thank you for buying a Hitachi MB-S1 Series Personal Computer.
The large scale integrated circuits (LSIs) in this unit are built with Hitachi developed electronic technology. They provide excellent operability, compactness and vastly upgraded color graphics functions for a wide range of personal computer applications from computer games and hobbies to personal business.
The MB-S1/10 and the MB-S1/20 are the two systems in the MB-S1 Series. In addition to all the functions of the MB-S1/10, the MB-S1/20 has a Kanji ROM (JIS Standard No. 1) and a Kanji Dictionary ROM as standard equipment so that it can be used as a Japanese-language word processor.
If you're the owner of an MB-S1/10, you can easily upgrade to MB-S1/20 functions by purchasing the MPC-KA01S Kanji ROM Card and the MA-5821 Japanese Language Word Processor.

CAUTIONS IN HANDLING

[CAUTIONS WITH POWER]

- **Take good care of power cords**
  Lay the power cord under the set so that it won't be damaged. Using a damaged power cord is dangerous. When you're removing the plug from the socket don't pull on the cord. Hold the plug and remove the cord gently from the socket.

- **90V-110V voltage**
  Use a voltage source that is within the 90V to 110V range. Voltages outside this range can cause abnormal operations.

- **Turning power ON again**
  If you turn the power switch OFF and immediately turn it back ON again, nothing will be displayed on the screen. Nothing's wrong with your MB-S1, but once you do turn OFF the power switch, wait at least five seconds before you turn it ON again.

[CAUTIONS IN REGARD TO ENVIRONMENT AND STORAGE]

- **Operating temperature of 5°C ~ 35°C, operating humidity of 20% ~ 80%**
  Always use your MB-S1 in a room where the temperature is between 5°C and 35°C and humidity between 20% and 80%. The MB-S1 may not operate normally outside those ranges.

- **Make sure the area is well ventilated**
  The case has ventilation ports on the side to allow air to pass through and prevent temperatures inside from rising. Don't block those ports or use your machine in a place where ventilation is not good. Don't use or store the machine in an area where there's a lot of dust.

- **Be careful with magnetic fields**
  Don't place the MB-S1 close to any devices which generate strong magnetic fields like a TV, speaker system or a magnet. A magnetic field can destroy your data.

- **Shock and vibrations can damage your machine**
  Your MB-S1 Personal Computer is made with precision electronic components. Don't use it or store it in area where it could be affected by bumping or vibrations.

- **Keep chemicals and water away**

  Avoid using or storing the MB-S1 in an area where it could come into direct contact with chemical substances or where chemical fumes are in the atmosphere. If any water or other fluid should get into the unit, don't use your MB-S1. Remove the plug from the wall socket call the store where you purchased your system and have them service it. Liquids can damage the system and using the unit after liquids have entered the case could cause high-voltage shock.

- **Putting foreign objects inside is dangerous**

  Inserting metal or inflammable objects in the gaps of the unit case can cause electrical shock or fire.

- **Leave the cover on**

  Storing or using the unit with the cover or blank rear panel off could cause an electrical shock to you or damage your unit. Always use it with the covers in place.

- **Don't touch connectors**

  Don't touch any of the connector terminals on the back panel; such handling can damage the unit.

- **Don't place anything on top of the unit**

  Don't use or store your unit with cassette tapes or any heavy objects on top of it other than the unit display.

- **If the unit interferes with radio or TV communications**

  The radio frequency energy generated, used and radiatable from the unit may cause interference to radio or TV communications if your MB-S1 is used close to a radio or television set. On the other hand, if you operate your MB-S1 close to a device emitting strong magnetic fields or interference it may affect normal computer operations. If either should occur, move your unit away from such sources or recipients of interference.

- **Thunderstorms**

  If a severe thunderstorm should occur in your area, turn OFF the power switch and remove the plug from the wall socket to prevent damage to the unit or electrical shock to yourself.

- **If you won't be using the computer for some time**

  If you're going to be away or won't be using the unit for a long period of time for some other reason, remove the plug from the wall socket.

- **Don't set floppy disks or cassette recorders close to the display**
  Placing data media on top of or close to the display can cause abnormalities in the writing or reading of the media or even erase data completely.

- **Connecting peripheral devices**
  If you're going to connect peripherals to the unit, make sure that they are specified for use with the MB-S1. Use of any other devices may affect quality guarantees. Even when using specified peripherals, make sure you read and fully understand the operating manual for the device before using it.

- **Don't touch the display screen**
  Touching a display or TV screen during operation can cause static electric charge. Avoid excess touching of the display screen.

- **Don't turn peripheral device power OFF**
  Turning peripheral device power OFF during the operation of this unit can result in abnormal operations.

- **Care when connecting a cassette recorder**
  The MB-S1 is designed for use with the Hitachi TRQ-359 Cassette Recorder and the TRQ-1500 and TRQ-2400 Data Recorders. Use of any other cassette recorder may result in abnormal operations.
  Operations may also be abnormal if one type of cassette recorder is used for data write and another type is used for data read.

[MISCELLANEOUS]

- **Surface care**

  Wipe the unit and keyboard clean with a soft cloth. For heavier soiling, dip a soft cloth in a diluted neutral detergent and wring out well. Wipe clean and then wipe again with a dry cloth. Use of volatile materials such as benzene or thinner, chemically permeated cleaning cloths, or insecticides will damage the unit surface. Long periods of contact with rubber or vinyl substances will mar the surface.

- **To expand**

  If you want to add on components such as an interface or you want greater memory size, consult the sales outlet where you purchased your MB-S1 Personal Computer.

- **Installing option cards in the unit**

  Only a service representative from your Hitachi personal computer outlet should install option cards in your MB-S1.

  Never remove the cover from your MB-S1, you could receive a serious electrical shock.

MALFUNCTIONS AND ABNORMALITIES

If you should notice any damage or abnormality such as unusual odors or heat, turn OFF the power switch, remove the plug from the wall socket and contact your Hitachi personal computer outlet for service.

CHECK OF EQUIPMENT PROVIDED AND USES

Check to make sure all the equipment listed below has been provided with your MB-S1. The table also describes how the article is used.

Product name	Quantity	Use
Keyboard	1	Connect to the main unit and use to enter Kanji, symbols, etc.
Operation Manual (this manual)	1	Describes the methods for handling, the way to connect peripherals, operational procedures and system specifications. Make sure that you learn all of them.
BASIC Manual	1	Provides a detailed explanation of BASIC, the language used in programming the MB-S1.
Guide to using BASIC	1	Lists the BASIC commands.
Cassette Tape	1	Stores the demonstration program.
Cassette Cable	1	The cable used to connect the main unit and the cassette recorder.
Japanese Language Word Processor (5.25-inch diskette) (provided only with the MB-S1/20)	1	Stores the program for using the Japanese Language Word Processor.
Operation Manual for the Japanese Language Word Processor (provided only with the MB-S1/20)	1	Describes the operational procedures for using the Japanese Language Word Processor.

■ **Note: Some of the components provided with the MB-S1/20 are not provided with the MB-S1/20.**

MANUAL CONTENTS AND HOW TO USE THEM

This manual was compiled so that you can fully understand the functions and features of the MB-S1 Personal Computer and correctly and effectively use the machine.

[From connecting devices to turning ON the power]

- **Conditions to maintain in power, operating environment and storage** . . . . . Cautions in Handling

  The section on cautions in handling tells you how to make sure that you enjoy your MB-S1 for a long time.

- **Checking components** . . . . . Check of Equipment Provided and Use

  This section tells you what the components are that have been provided with your MB-S1 and how to use them.

- **Overview of the MB-S1 Series** . . . . . Section 1

  This section describes the features of the hardware and software. Reading it will give you a good overall understanding of the MB-S1.

- **Selecting peripheral devices and configuring your system** . . . . . Section 2

  This section tells you about all the peripherals and other options available in order to get even wider use from your MB-S1. Refer to the items listed here to select your system configuration. Catalogs and microcomputer magazines available at your local Hitachi outlet will tell you about the new equipment for the MB-S1 that we'll be offering in the future.

- **Connecting peripherals** . . . . . Section 3

  This section talks about the points to watch for when connecting peripherals to the main unit.

- **Starting up the system** . . . . . Section 4

  Describes how to start up the BASIC programs contained in the unit. The MB-S1 has two types of BASIC, S-1 BASIC and LEVEL-3 BASIC, and the methods for starting up each are different. Make sure you full understand the start-up procedures before using the programs.

[Using the Keyboard] . . . . . Section 5

This section tells you how to use the keyboard and how each one of the keys function. Keyboard operations are very important, so press each one of the keys while you're reading about their functions in the manual so you know exactly how they work.

[System Mode A (S1 BASIC)] ..... Section 6
Gives an overview and describes the specifications of system (S1 BASIC).

[Writing and Reading Programs]

- **Using the cassette recorder** ..... Sections 2, 3 and 7
  Describes how to write and read programs to and from cassette tape.

- **Using floppy disks** ..... Sections 2, 3 and 8
  Gives a general description of the floppy disk and floppy disk drive and shows you how to use them.

[Expanding the System]

- **Adding on peripherals** ..... Section 9
  Introduces the types and functions of the main peripheral devices.

- **Using the RS-232C lines** ..... Section 10
  Describes how to connect the optional RS-232C interface to the unit and how to use the RS-232C line.

[Getting more out of your MB-S1] ..... Section 11
So that you can use the functions of the machine more effectively, this section gives a detailed description of hardware such as the configuration of the hardware register for controlling MB-S1 functions.

- **MB-S1 series hardware specifications** ..... Section 12
  List of the hardware specifications.

To the Service Representative

Only authorized service representatives from Hitachi personal computer outlets can perform the procedures required for system expansion. This section describes those procedures.

Section 1. Features of the MB-S1 Series

1-1 General Description of System

■ **Uses Hitachi's independently developed electronics technology**

The MB-S1 Series of personal computers were developed using Hitachi's own electronic technology with standard equipment that includes the advanced function 8-bit 68B09E MPU (microprocessor unit; the LSI used central processing of arithmetic/logic operations), new high-performance dedicated LSIs in the electronic circuits and large-sized memory. Operability has been improved by separating the keyboard unit from the main unit. The means the MB-S1 System can be used for a wide range of uses from beginner applications in games and hobbies to advanced uses in personal business.

■ **Strengthened graphics functions and expanded memory area**

The MB-S1 Series were developed as the host for the MB-6890, MB-6891 and MB-6892 Basic-Master Level-3 Series. It now has upgraded graphics functions and larger memory area.

■ **Software compatibility**

To ensure software compatibility with previous electronics modules, the MB-S1 has two operational modes, system mode A and system mode B. Features of the two modes are listed here.

(1) System Mode A

The functions of system mode A have been upgraded with an advanced function color graphics display and musical accompaniment and Kanji display (the MPC-KA01S Kanji ROM Card is an option in the MB-S1/10) for Japanese language processing. This operational mode offers high expansion potential for many varied future uses such as mouse connection, and important adjunct to personal computer use.

Advanced function, expandable BASIC (HITACHI S1 BASIC) can be used in system mode A.

(2) System Mode B

In addition to light pen functions, the system mode B offers full software compatibility with our present Basic-Master Level-3 Series. This means that all software developed for the Basic-Master Level-3 Series can be used in the MB-S1 System.

1-2 Hardware Features

The major hardware features are:

- **Advanced function 8-bit 68B09E MPU**

- **Newly-developed high-performance dedicated LSIs**

- **Large-sized memory as standard equipment**

RAM	48KB	for program storage
RAM	52KB	for character and graphics display
RAM	6KB	for the image generator
ROM	24KB	LEVEL-3 BASIC
ROM	64KB	S1 BASIC
ROM	6KB	character generator
ROM	160KB	JIS standard No. 1 Kanji ROM (optional with the MB-S1/10)

- **Superior display functions**

Character display screen configuration	
	80 characters x 25 lines (2,000 characters)
	40 characters x 25 lines (1,000 characters)
	Displayed colors 8
Graphics display	Resolution 640 dots x 200 dots
	320 dots x 200 dots
	Displayed colors 8
Kanji display	40 characters x 12 lines
Color Palette	Select 8 colors from 15 possibilities

- **Using the Image Generator (IG)**

Number of definable characters	256
Character configuration	8 dots x 8 dots
Color unit	1 dot

- **Three-chord, 8-octave musical accompaniment**

- **Wide variety of internal interfaces**

  Cassette interface
  Color video interface
  Monochroma video interface
  Line interface (RS-232C interface specifications and connector are optional)
  Printer interface

■ **Wide range of expandability**

Two connectors for interface expansion

Connector for video superimpose card expansion

Socket for mouse interface*

* The MP-3710 Mouse, available by separate purchase, can be used by installing the supplied mouse interface IC in the main unit socket.

■ **Compact, space-saving design**

■ **Non-attached keyboard for greater ease in operations**

1-3 Software Features

The two programming languages used in the MB-S1 Series are S1 BASIC and LEVEL-3 BASIC.

■ S1 BASIC

This is an upgraded BASIC programming language which is based on LEVEL-3 BASIC.

S1 BASIC is compatible with LEVEL-3 BASIC at the character format level.

S1 BASIC operates in system mode A.

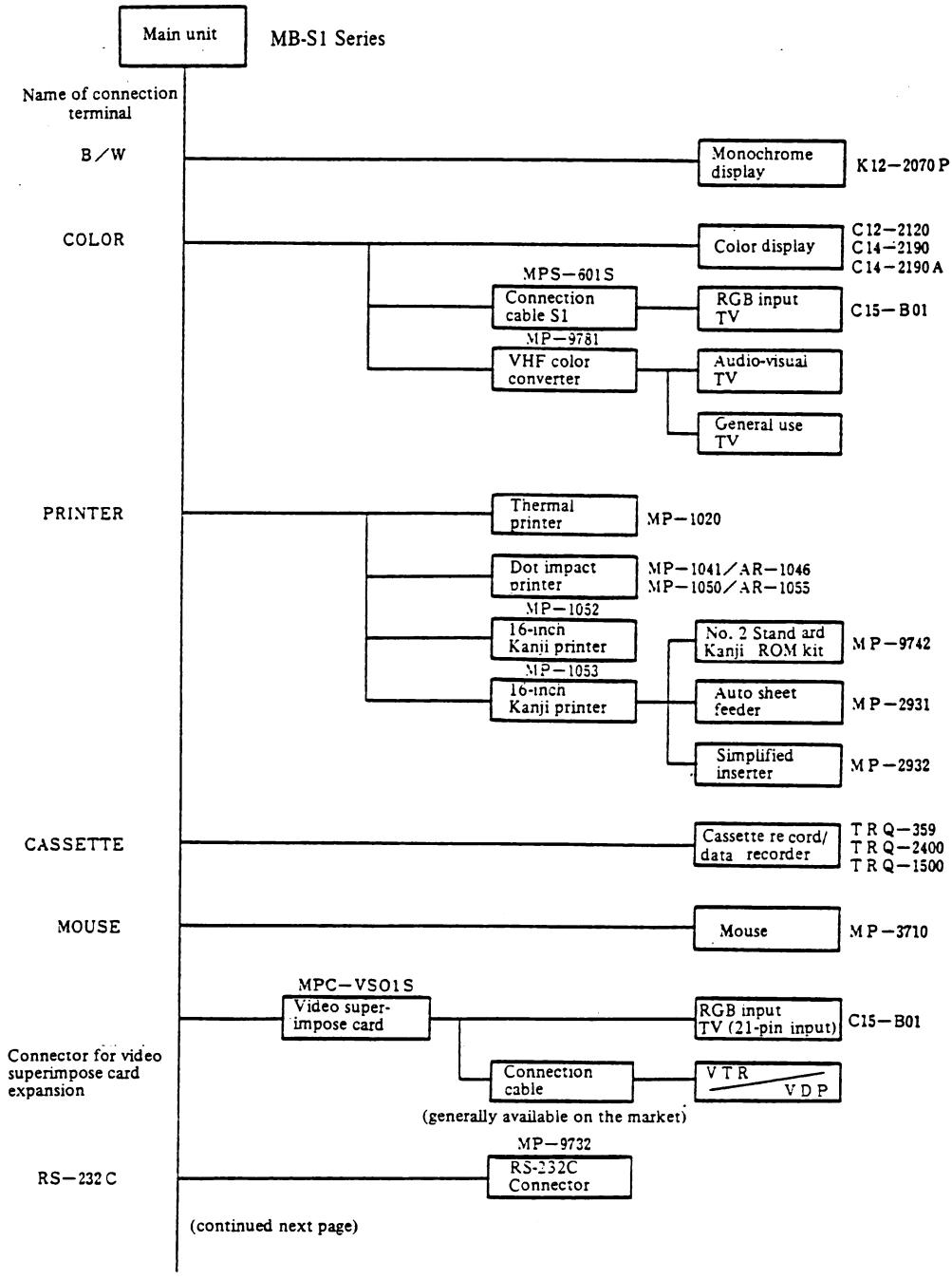
■ LEVEL-3 BASIC

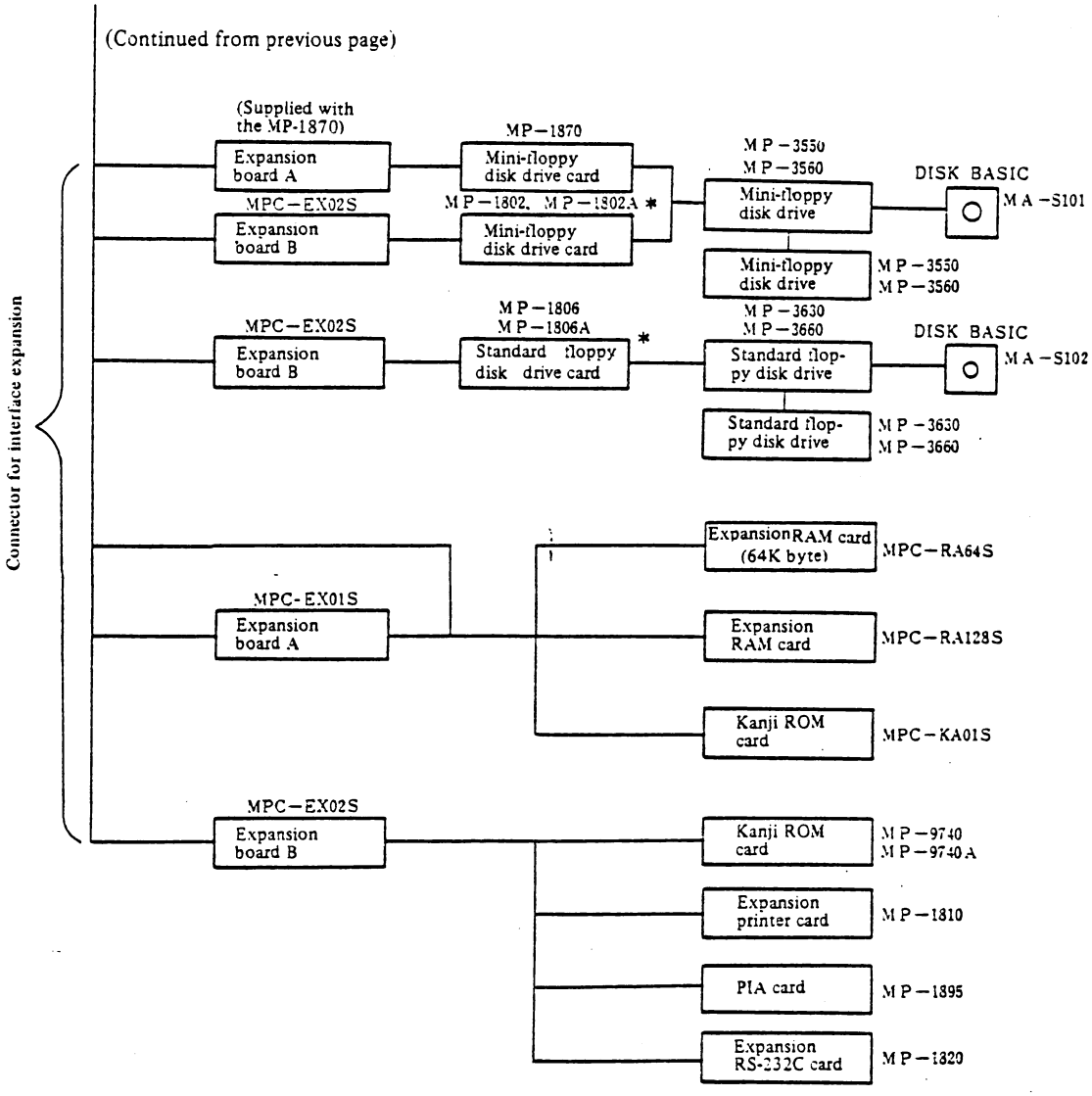
Except for the light pen functions, LEVEL-3 BASIC is compatible with BASIC-MASTER LEVEL-3 and can use software developed for the BASIC-MASTER LEVEL-3.

LEVEL-3 BASIC is operated in system mode B.

This unit is equipped with a wide variety of peripheral devices for system expansion. This chapter describes the various peripheral devices that can be used in combination with the main unit as well as the interface and expansion cards that are required.
For details on the major peripheral devices, see Section 10 "System Expansion."

2-1 System Configuration Diagram





■ Notes: 1) Up to four expansion cards can be installed by using expansion board A or expansion board B in this unit.

2) Cards marked with an asterisk (*) are two-card configurations (two cards in one group). The MP-8015 Compact Floppy-Disk Drive Card also has a two-card configuration.

2-2 Examples of System Configurations

This section gives examples of system configurations.

2-2-1 Minimum System Configuration

Main unit	MB-S1
Color Display	C12-2120
or [RGB input TY	C15-B01]
[Cable for Color Display	MPS-601S]
Cassette Recorder	TRQ-1500 (data recorder)

The minimum configuration of the MB-S1 System is the main unit connected to a display device, either the C12-2120 Color Display or the C15-B01 RGB Input TV (also usable as a standard color TV), and to a cassette recorder used as the external memory device. If you are going to use a household TV that does not have an RGB input terminal you will need to purchase and install the MP-9781 VHF Color Converter. When using a standard home TV with VHF color converter, 1,000 characters will be displayed (40 characters x 25 lines) and there will be some flickering of the hiragana character display.

2-2-2 Standard System Configuration (1)

Main unit	MB-S1
Color Display	C12-2120
Mini-floppy Disk Drive	MP-3560
Mini-floppy Disk Drive Card	MP-1870
(MPC-EX01S Expansion Board A	MPC-EX01S ..... This part is included in the MP-1870)
DISK BASIC	MA-S101 (or MA-5320)
Dot matrix impact printer	MP-1041

The standard system configuration contains the C12-2120 Color Diaplay, the MP-3560 Mini-floppy Disk Drive for external memory and the MP-1041 Dot-matrix Impact Printer all of which are connected to the main unit. The MB-S1 System is a basic personal computer system because the mini-floppy disk drive allows faster program read/write speeds than the cassette recorder and you can print out program lists, etc., with the printer.
Use MA-S101 DISK BASIC for system software.
The MP-1802A can also be used as a mini-floppy card but this will require the installation of an MPC-EX02S Extension Board B.

2-2-3 Standard System Configuration (2)

Main unit	MB-S1
Color Display	C14-2190A
Mini-floppy Disk Drive	MP-3560
Mini-floppy Disk Drive Card	MP-1870
(MPC-EX01S Expansion Board A	MPC-EX01S ..... included in the MP-1870)
DISK BASIC	MA-S101 (or MA-5320)
Dot Matrix Impact Printer	MP-1050
Mouse	MP-3710

This is the highest level system configuration in which the C14-2190A Color Display is the display unit, the MP-3560 Mini-floppy Disk Drive is the external memory unit, the MP-1050 Dot Matrix Printer is the printer and all are connected to the main unit. The MB-S1 System can be used in a wide range of applications from beginner to business uses since the mini-floppy disk drive handles large-sized programs and data at high speeds. It's easy to make any kind of graphics display using the attachable MP-3170 Mouse. To reduce screen flicker when you're displaying Kanji, you should use the C14-2190A Color TV.

Use MA-S101 DISK BASIC for system software.

The MP-3710 Mouse cannot be used in system mode B.

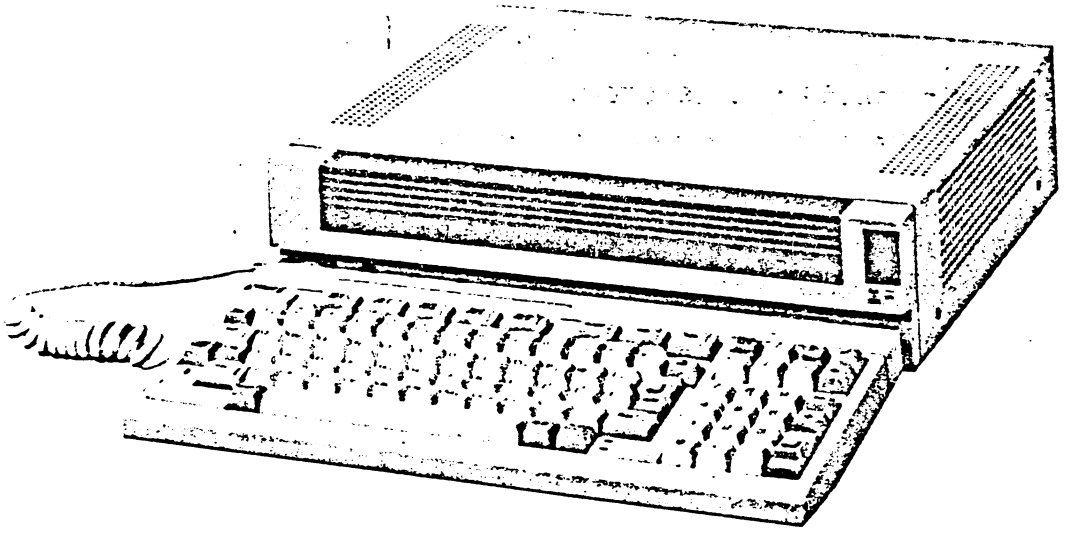
Section 3. Connecting Peripherals to the MB-S1

This section describes points to watch out for in the procedures for connecting main unit to peripheral devices.

- **Caution:** When connecting peripherals make sure that power to all devices is OFF. Remove the plug from the wall socket first and then begin connecting. Units can be damaged if connections are made with the power ON.

3-1 MB-S1 Main Unit

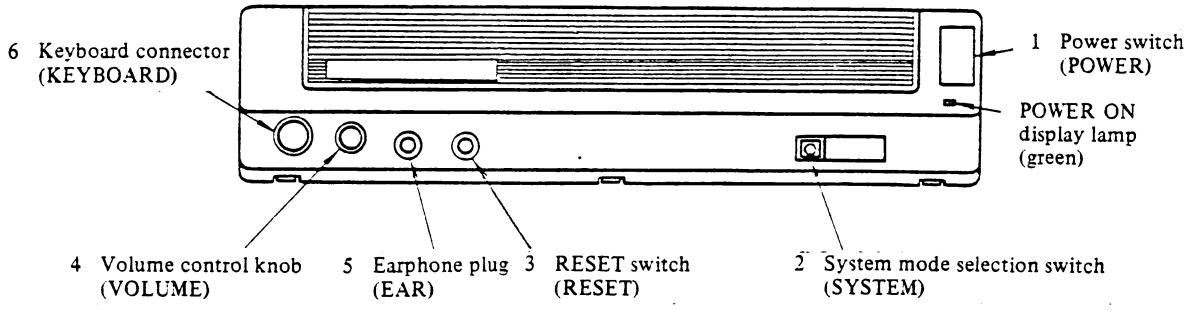
3-1-1 Exterior View



Main unit and Keyboard

3-1-2 Names and Functions of Each Main Unit Part

(1) Main unit front panel



1 Power Switch (POWER)

Press this switch to turn power to the main unit ON. The green power display lamp will light. Press once more to turn the power OFF and the green power display lamp will go OFF.

2 System mode selection switch (SYSTEM)

This switch sets the system mode. Simply stated, this switch is used to select either system mode A or system mode B, but before doing so you should look at the detailed explanation in 4 "Starting Up the System." You can use an object like the eraser end of a pencil to press the switch.

3 RESET switch (RESET)

This switch forcibly stops program runs that can't be stopped with the key entry methods in 5 "Keyboard." When you're in system mode A and you press the RESET switch, all programs and data that have been input will be deleted. After you have changed the system mode selection switch (SYSTEM), press the RESET switch to select system mode.

4 Volume control knob (VOLUME)

Use this knob to adjust the loudness of the internal speaker and the earphone plug. Turning the knob to the right raises the volume and turning it to the left lowers the volume.

Lower  Higher

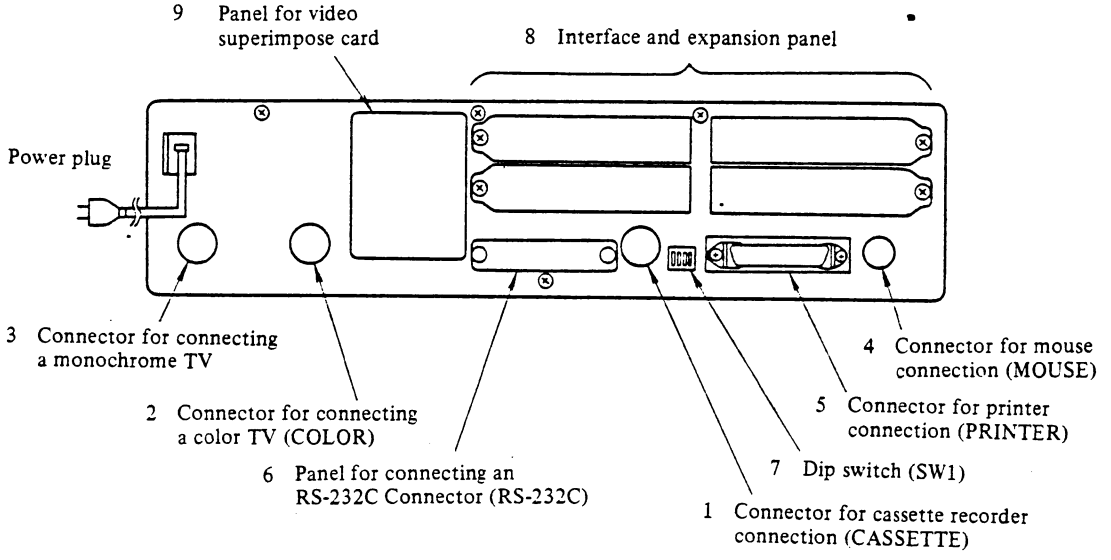
5 **Earphone plug (EAR)**

Insert the earphone (separate purchase) jack into this plug. When the earphone is plugged in, no sound will be emitted from the internal speaker.

6 **Keyboard connector (KEYBOARD)**

Connect the keyboard cable to this connector. For further details see 3-1-3 "Connecting the Keyboard."

(2) Main unit rear panel



1 **Connector for cassette recorder connection (CASSETTE)**

Use to connect the cassette recorder. Use the cassette cable built in to the unit to make the connection.

2 **Connector for connecting a color TV (COLOR)**

Use to connect the color display (C12-2120, C14-2190 or C14-2190A) or the RGB input TV (C15-B01).

3 **Connector for connecting a monochrome TV (B/W)**

Use to connect the monochrome display (K12-2070P).

4 **Connector for mouse connection (MOUSE)**

Use to connect the mouse (MP-3710).

5 **Connector for printer connection (PRINTER)**

Use to connect the printer (MP-1041, MP-1050, MP-1052, MP-1053 or MP-1020).

6 **Panel for connecting an RS-232C connector (RS-232C)**

Use to attach the optional RS-232C connector (MP-9732). For more information, see Section 11, "RS-232C Connector (Option)."

7 **Dip switch (SW1)**

This switch is used to set the RS-232C baud rate, the type of cassette recorder used and display output signals. For further information, See 10-2, "Setting Baud Rate," and 11-4, "Setting the Dip Switch."

8 **Interface and expansion panel**

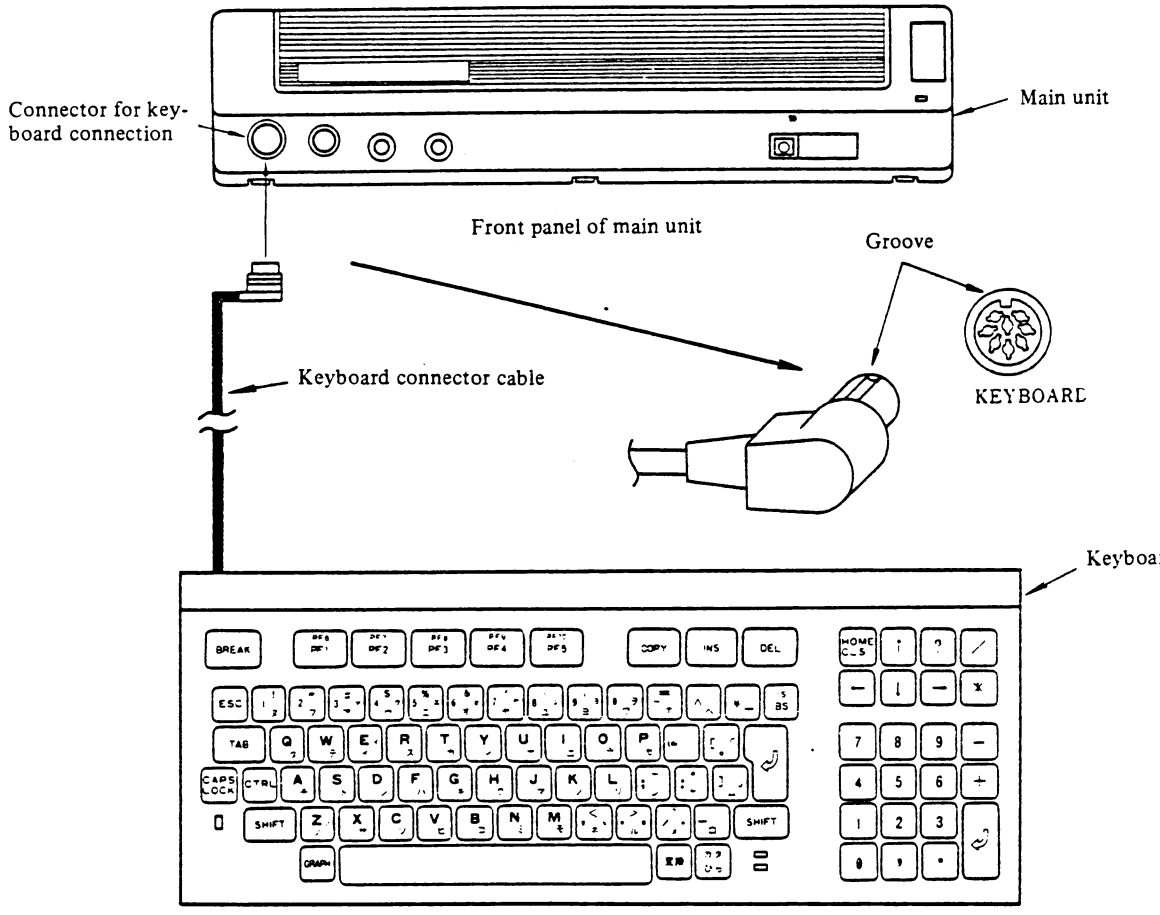
This is the panel used to connect interfaces for peripheral device attachment and for attaching optional cards for system expansion. Four blank panels is the standard.

9 **Panel for video superimpose card**

This is the panel for attaching the control panel for the MPC-VS01S Video Superimpose Card. This panel is standard. For further information see the operation manual on the MPC-VS01S Video Superimpose Card.

3-1-3 Connecting the Keyboard

Connect the keyboard to the main unit by inserting the keyboard connector cable into the keyboard connector on the front panel of the main unit as shown below.



3-2 Connecting the Display

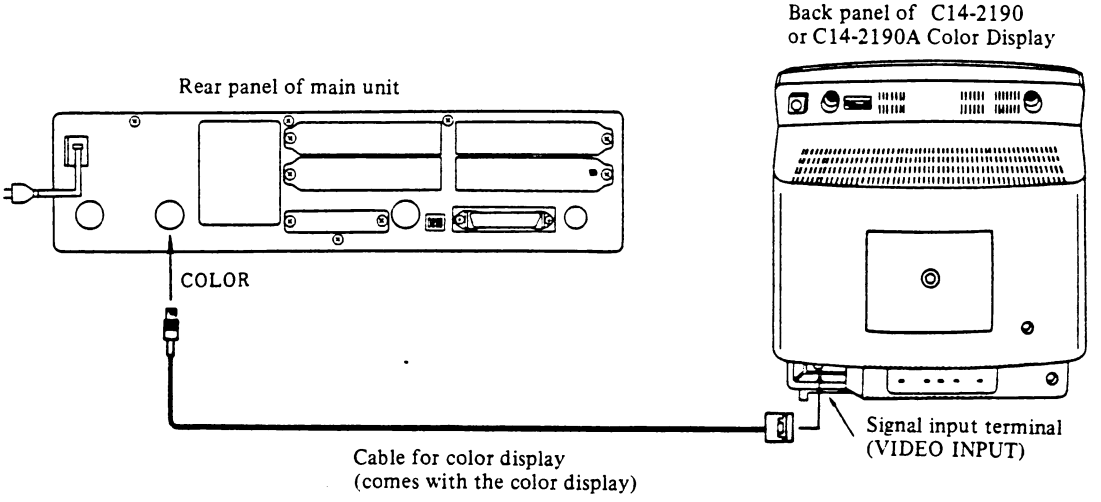
The table below lists the display units that can be connected to the MB-S1 main unit. Select your display according to what you want to use it for.

Display		Features
Color	C12-2120	Compact 12-inch cathode-ray tube (short persistence phosphor type). Use for games and general graphics.
	C14-2190 C14-2190A	Long-persistence phosphor type cathode-ray tube. Use for hiragana and Kanji display.
RGB input TV	C15-B01	1. In combination with the MPC-VS01S Video superimpose Card can be used to superimpose the personal computer screen on VCR, video disk or TV screen. 2. Can also be used as a standard color TV.
Monochrome	K12-2070P	Long-persistence phosphor type cathode-ray tube. (Monochrome display dedicated)

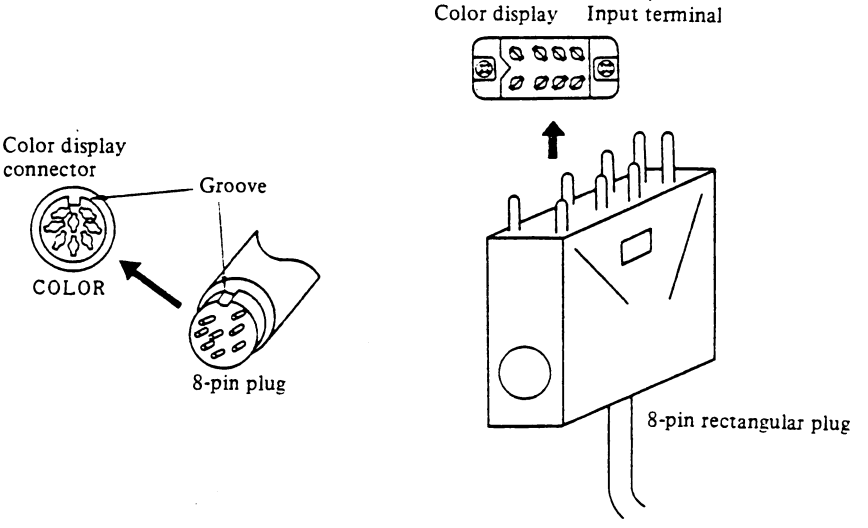
■ **Cautions:**
1. The eyes may tire from looking at the flickering of the Kanji and hiragana display on the C12-2120 Color Display or the C15-B01 RGB Input TV. We recommend the C14-2190 or the C14-2190A Color Display because they reduce flickering of Kanji and Kana displays.
2. If you are going to use the Japanese language processor which is standard on the MB-S1/20 (option for the MB-S1/10), use the low-flicker C14-2190A Color Display.

3-2-1 Connecting the Color Display

To connect the C12-2120, C14-2190 or C14-2190A Color Display to the MB-S1 main unit, use the color display connecting cable that comes with the display. Insert the 8-pin plug on the cable into the color display connector on the main unit and insert the cable's 8-pin rectangular plug into the display's signal input terminal.

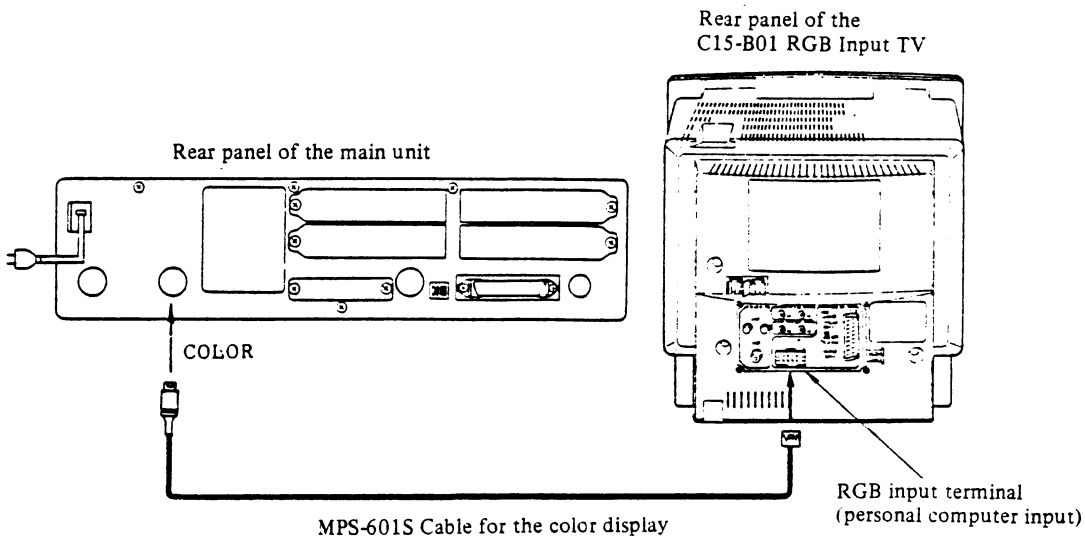


Hold the 8-pin plug so that the groove is on top and insert the plug into the color display connector (COLOR) on the main unit. Insert the 8-pin rectangular plug on the color display cable into the signal input terminal in the color display.



3-2-2 Connecting the RGB Input Television

Use the separately purchased MPS-601S Color TV Cable to connect the C15-B01 RGB Input TV to the MB-S1 main unit.
Use the connector cable provided with the MPC-VS01S Video Superimpose Card when using the MPC-VS01S Video Superimpose Card to connect the RGB input TV.

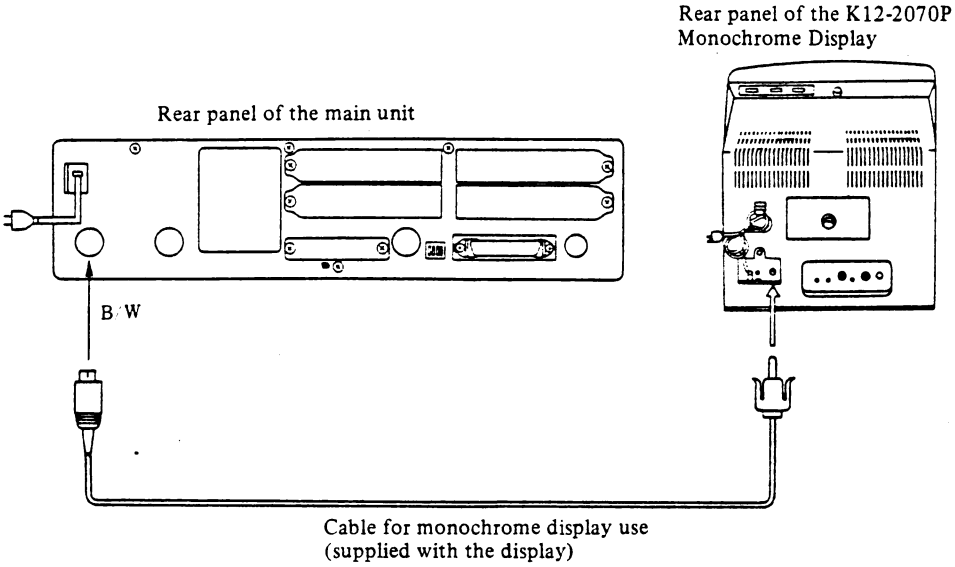


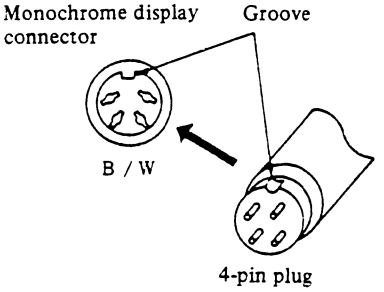
Hold the 8-pin plug with the groove facing upwards and insert the plug into the color display connector.
Insert the 8-pin rectangular plug on the color display cable into the RGB input terminal on the RGB input TV.

■ **Caution:** Kanji and hiragana displayed on the screen of the C15-B01 RGB Input TV will flicker.

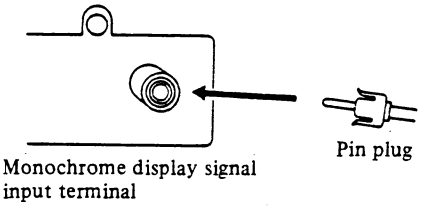
3-2-3 Connecting the Monochrome Display

Use the monochrome display cable provided with the display to connect the K12-2070P Monochrome Display to the MB-S1 main unit.





Hold the 4-pin plug with the groove facing upwards and insert the plug into the monochrome display connector (B/W).



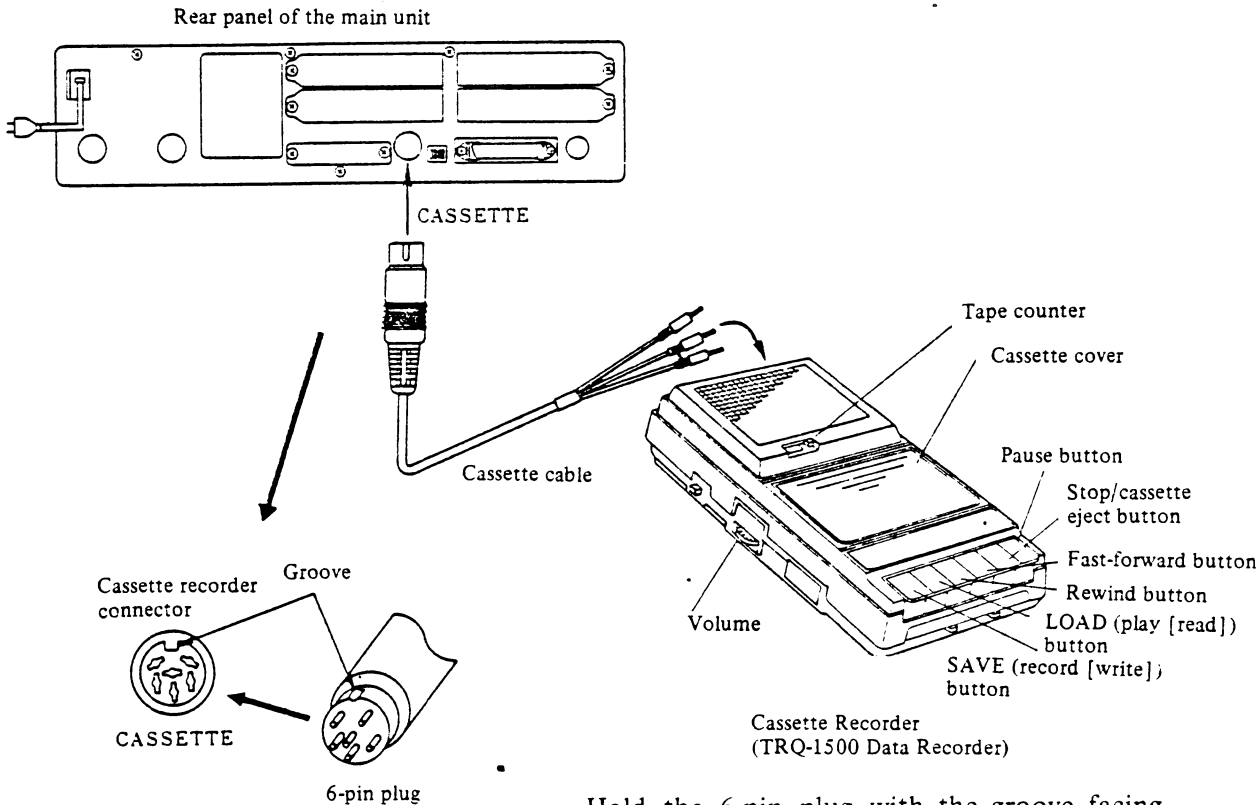
Insert the pin plug on the monochrome display cable into the monochrome display's signal input terminal.

3-3 Connecting the Cassette Recorder

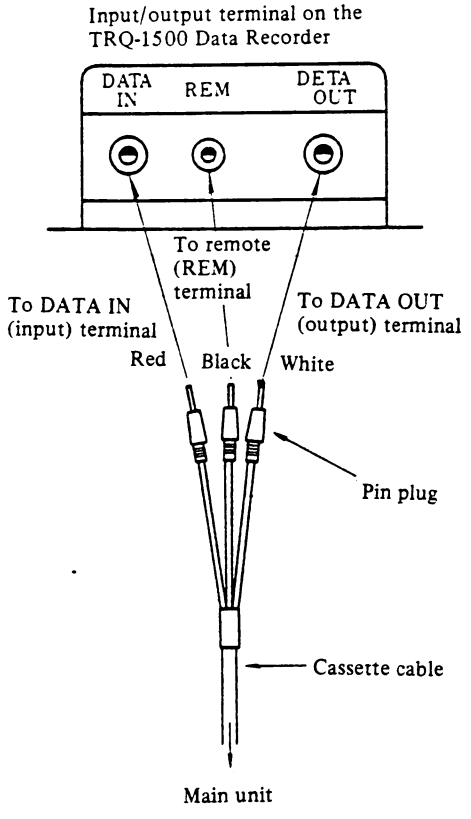
Use the cassette cable provided with the main unit to connect the cassette recorder to the unit.

Cassette Recorder		Features
Cassette Recorder	TRQ-359	For general audio recording
Data Recorder	TRQ-1500 TRQ-2400	Especially for personal computer use

When using the TRQ-359, place the dip switch on the back panel of the main unit in the correct position as shown in 12-4, "Setting the Dip Switch."



Hold the 6-pin plug with the groove facing upwards and insert the plug into the cassette recorder connector (CASSETTE).



There are three colors of pin plugs on the cassette cable: black, red and white.

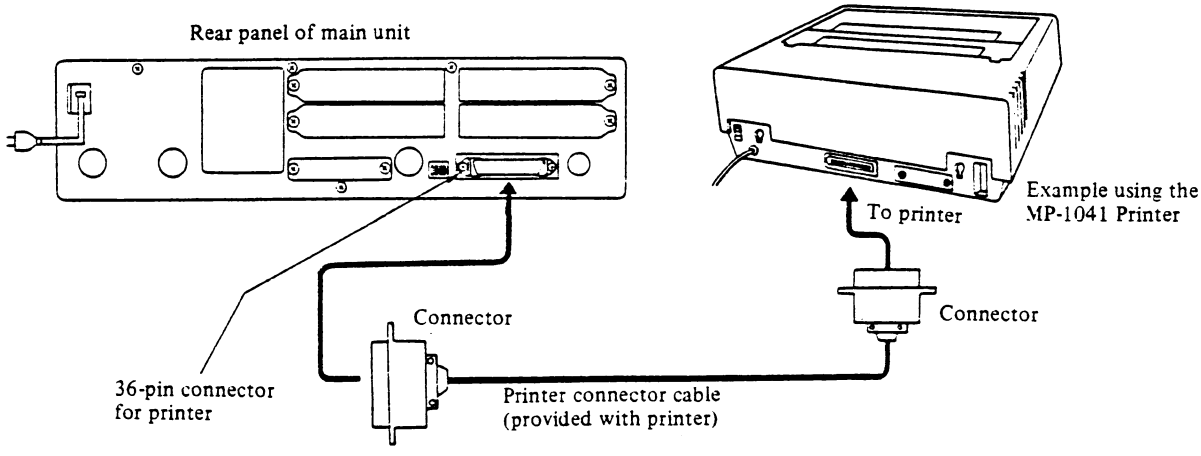
- Red ..... Connect this plug ot the input (DATA IN) terminal on the cassette recorder.
- White ..... Connect this plug to the output (DATA OUT) terminal on the cassette recorder.
- Black ..... Connect this plug to the remote control (REM) terminal on the cassette recorder to control the tape forward and stop.

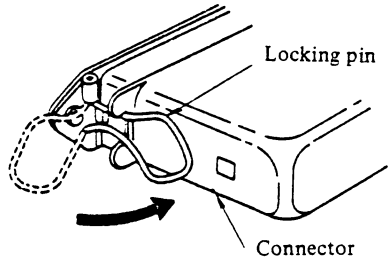
■ **Caution:** On some cassette recorders, the input terminal may be designated as MIC and the output terminal designated as EAR.

3-4 Connecting the Printer

Use the printer connector cable supplied with the printer to connect the printer to the main unit.

Printer		Features
Dot matrix impact printer	MP-1041 MP-1050	Standard printer
16-inch Kanji printer	MP-1052 MP-1053	Can print JIS standard No. 1 Kanji characters
Thermal printer	MP-1020	Low noise





Use the printer connector cable to connect the main unit printer connector (PRINTER) to the connector on the printer and then use the locking pins to fasten the connectors so that they will not be pulled out.

3-5 Connecting the Floppy Disk Drive

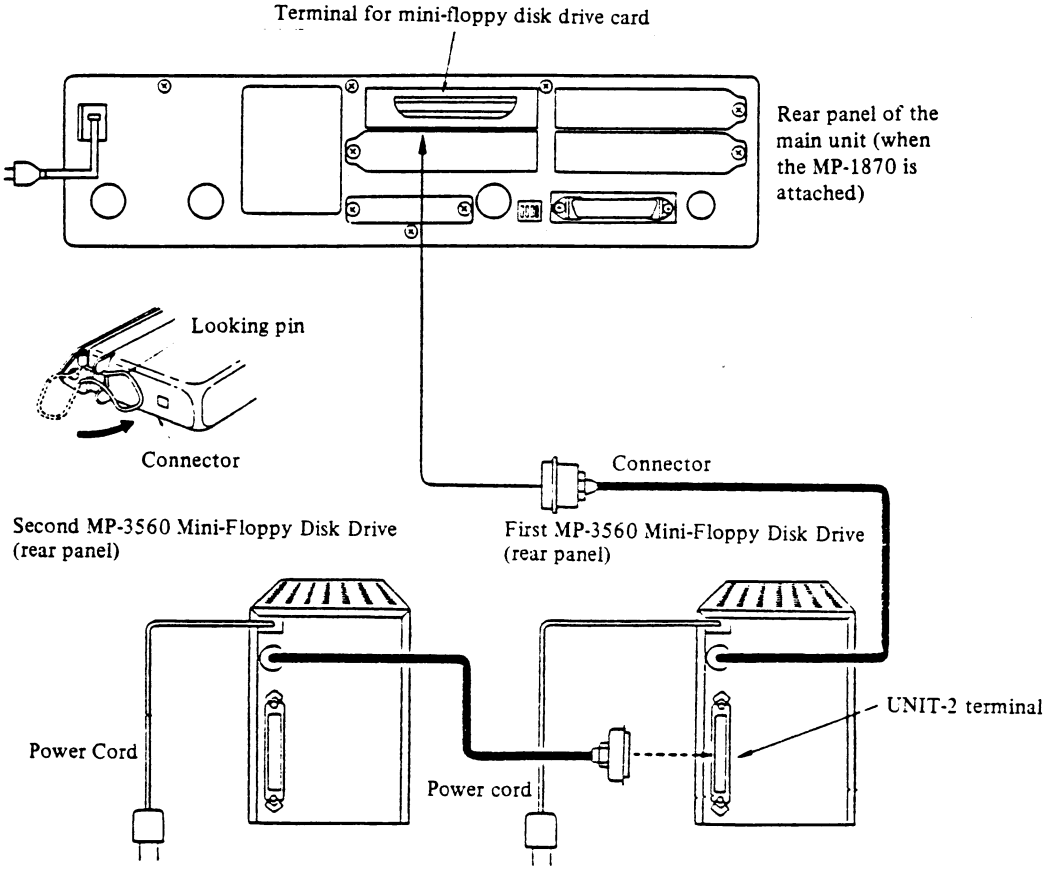
To connect the floppy disk drive to the main unit you will need a separately purchased interface card for each floppy disk drive and an expansion board A or an expansion board B.

Floppy Disk Drive		Interface Card	Model Number	Remarks
Mini-floppy disk drive	MP-3560 MP-3550	Mini-floppy disk drive card		Provided with the MPC-EX01S Expansion Board A.
		Mini-floppy disk drive card	MP-1802 MP-1802A	Requires the separately purchased MPC-EX02S Expansion Board B.
Standard floppy disk drive	MP-3660 MP-3630	Standard floppy disk drive card	MP-1806	

3-5-1 Connecting the Mini-Floppy Disk

The MP-3560 Mini-Floppy Disk Drive is connected to the main unit as shown in the diagram below. If you are using the MP-1870 Mini-Floppy Disk Drive Card, use the MPC-EX01S Expansion Board that comes with it. If you are going to use the MP-1802 or MP-1802A Mini-Floppy Disk Drive Card, you will have to purchase the MPC-EX02S Expansion Board B.

The connection of the MP-3550 Mini-Floppy Disk Drive to the main unit is performed in the same way as with the MP-3560.



Connect the connector cable on the mini-floppy disk drive to the terminal on the mini-floppy disk drive card that is, in turn, attached to the interface expansion panel on the main unit. If you are going to connect a second mini-floppy disk drive, connect it to the UNIT-2 terminal on the rear panel of the first mini-floppy disk drive. After connecting the connectors, lock them in place by securing the locking pins.

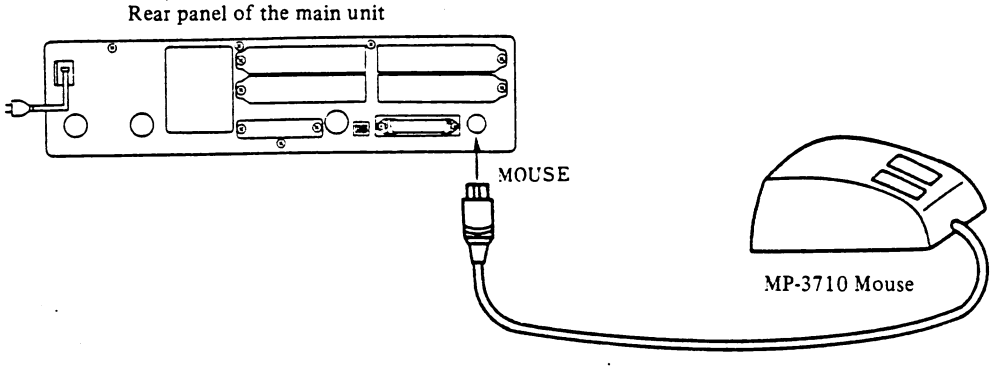
- The service representative from the Hitachi personal computer outlet will attach and adjust switches on the mini-floppy disk drive card for you.

3-5-2 Connecting the Standard Floppy Disk Drive

Use the MP-1806A Standard Floppy Disk Drive Card and the MPC-EX02S Expansion Board B to connect the MP-3660 or MP-3630 Standard Floppy Disk Drive.
The procedures for connecting the standard floppy disk drive to the main unit are the same as in 3-5-1.

3-6 Connecting the Mouse

To connect the MP-3710 Mouse to the main unit, hold the 8-pin plug on the mouse cable so that the groove faces upward and then insert the plug into the mouse connector socket (MOUSE) on the rear panel of the main unit.



- **Caution:** In order to use the mouse, the mouse interface IC in the same package as the MP-3710 Mouse must be installed in the socket on the main unit circuit board. A service representative from the Hitachi personal computer outlet will install this IC for you.

3-7 Interface Expansion

Attaching and checking the operation of interface cards or optional cards in the main unit will be performed by a service representative from the Hitachi personal computer outlet. If you bring your MB-S1 in we will install the cards and check the prescribed operations of the system for you. If you expand your system by any other means, it will render the quality guarantees invalid.

- **Caution:** 100V AC is applied to many of the locations within the main unit. This presents a danger of electrical shock so never remove the module cover. All expansion of interfaces should be done by an authorized representative from your Hitachi personal computer outlet.

Section 4. Starting Up the System

The system is started up by turning ON electrical power and placing the main unit and peripheral devices in usable status.
The MB-S1 has two system modes as described in 1 "Features of the MB-S1 Series." System mode A (S1 BASIC) is the operational mode which allows you to use all the MB-S1 System's excellent functions. System mode B (LEVEL-3 BASIC) is the operational mode that offers software compatibility with the MB-6890, MB-6891 and MB-6892 Basic-Master Level 3 Series.
Select system mode A or B according to your purposes. The two modes are then started according to the procedures described below.

4-1 Turning On and Turning Off Power

4-1-1 Turning Power On

Turn the power ON to the MB-S1 system using the following steps.

(1) Connect the MB-S1 Series main unit to the peripheral devices according to the instructions given in 3 "Connecting Peripherals to the MB-S1."
(2) Insert the power plugs from the main unit and the peripheral devices into home electrical wall sockets (100V AC, 50/60 Hz).
(3) Use the system mode selection switch (SYSTEM) to select the mode you will be using. (When the switch is set to—A [selection switch up] the system is in system mode A, when the switch is set to B [switch depressed], the system is in system mode B.)
(4) Turn the power to peripheral devices ON first. The very last step in power input is turning ON the power switch on the main unit. If you're going to be using DISK BASIC, follow the procedural steps in 9-3 "How to Start Up DISK BASIC."

■ **Caution:** If there is no display on the monitor screen, perform the following check.

1. Make sure cables to all devices are connected correctly. If connections are correct, turn the brightness and contrast knobs on the display unit until the display appears.
2. If there is still no display on the screen, connect an ordinary electric lamp to the wall socket to make sure current is coming from the socket.
3. Remove all computer equipment power plugs from the wall sockets and repeat steps (1) to (4).

4-1-2 Turning Power Off

If you do not use the correct procedures in turning power OFF, you may lose all programs and data that you have input. Always use the following check list when turning power OFF.

(1) Have you stored all programs and data that you want to keep on cassette tape or floppy disk?

(2) Is the system now reading data from or writing data into cassette recorder or floppy disk? (Check to make sure that the cassette in the recorder has stopped or that the access indicator lamp on the floppy disk drive is out.)

(3) If you are using a floppy disk drive, remove the diskette from the drive. If one of the files on the diskette is still open, execute, the CLOSE command and then remove the diskette from the drive.

After you have gone through the entire checking procedure listed above, turn the power switches OFF for the main unit first and then for the peripheral devices. Do not turn the power ON again immediately after turning it OFF. If you do, nothing will be displayed on the screen. Wait at least five seconds after power OFF before turning the power ON again.

4-2 Checking the Start Up of System Mode A

Set the system mode selection switch (SYSTEM) on the front panel of the main unit to — A (the button is in the up position). After you have turned the power ON to the peripheral devices, turn the power ON to the main unit. The BASIC (HITACHI S1 BASIC) program inside the main unit will be started up. The following display will appear on the screen.
The small underline blinking ON and OFF under the word "Ready" is called the cursor. The display will be as follows.

```
HITACHI S1 BASIC Version 1.0
Copyright (c) 1984 By Hitachi, Ltd.
Copyright (c) 1980 By Microsoft
36K Bytes Free
BASIC User Area 36K Bytes

Ready
_
```

4-3 Checking the Start Up of System Mode B

Set the system mode selection switch (SYSTEM) on the front panel of the main unit to B (the button is pressed down). After you have turned the power ON to the peripheral devices, turn the power ON to the main unit. The BASIC (HITACHI LEVEL-3 BASIC) program inside the main unit will be started up. The following display will appear on the screen.

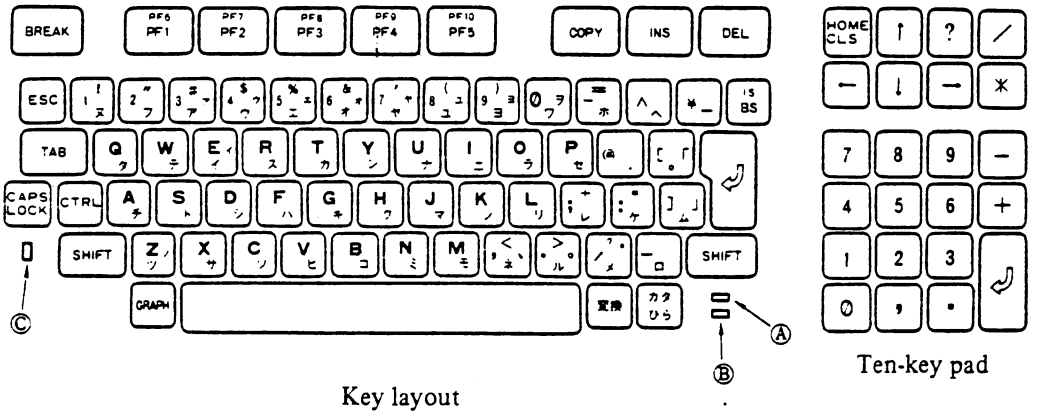
```
HITACHI LEVEL-3 BASIC Version 1.0
Copyright (c) 1980 By Microsoft
30570 Bytes Free
Ready
_
```

Section 5. Keyboard

This section describes the keyboard and the methods of operating the keyboard. First check to make sure that the system has been started up in system mode A. Keyboard operations for system mode A and system mode B do have some slight differences, but they are basically the same.

5-1 Key Arrangement

The diagram below shows the key layout. With the exception of the ten-key pad on the right-hand side, the key layout is that determined by Japan Industrial Standards (JIS), and is almost the same as that on almost every typewriter.



Key layout

Ten-key pad

Lamps A and B will light when the [カタ ひら] key is pressed in this sequence.

Lamp A is out Lamp B is out	→	Lamp A lights in red Lamp B goes out	→	Lamp A goes out Lamp B lights in green

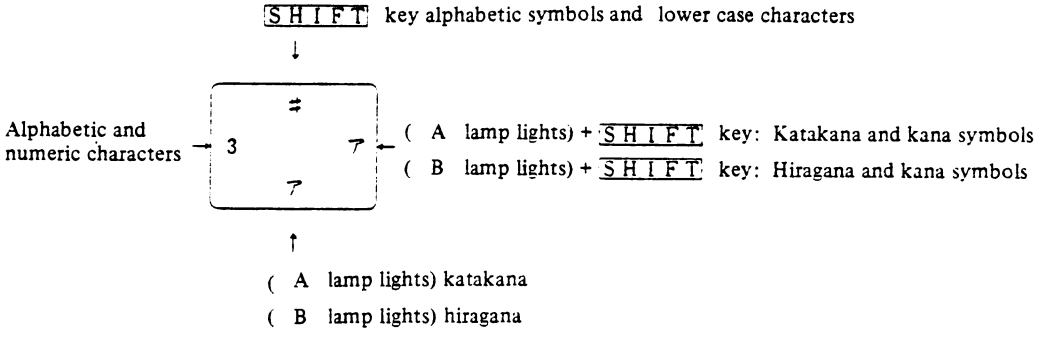
When the [CAPS LOCK] key is pressed, lamp C lights in red and when the [CAPS LOCK] key is pressed again, lamp C goes out.

5-2 Key Entry Methods

Sending commands and/or data to the main unit by pressing keys on the keyboard is called key entry or simply entry or input.

5-2-1 Entering Alphabet, Numerics, Katakana and Hiragana

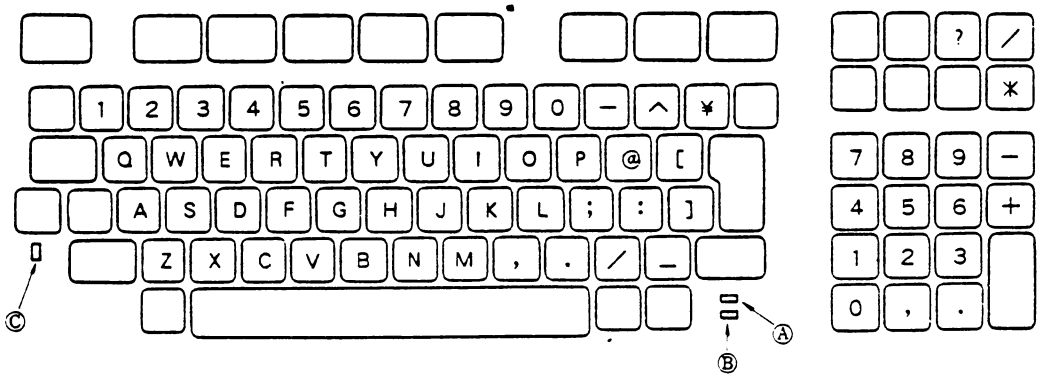
There are keys on the keyboard that can be used to enter either alphabetic, numeric, katakana or hiragana characters and those keys are known by the acronym ANK which stands for Alphabet, Numeric, Katakana.
The ANK keys have two or four characters inscribed on them. The inscribed characters are selected by pressing the SHIFT key and the カナ key.



The A and B lamps will not light immediately after power is turned ON. The characters which can be entered at this time are the alphabetics, numerics and some alphanumeric symbols inscribed on the left side of the keys. Press and hold the SHIFT key and then press the ANK key. Now you can enter the alphanumeric symbols inscribed on the top of the keys. You can now also enter the lower case characters from the alphabetic characters section.

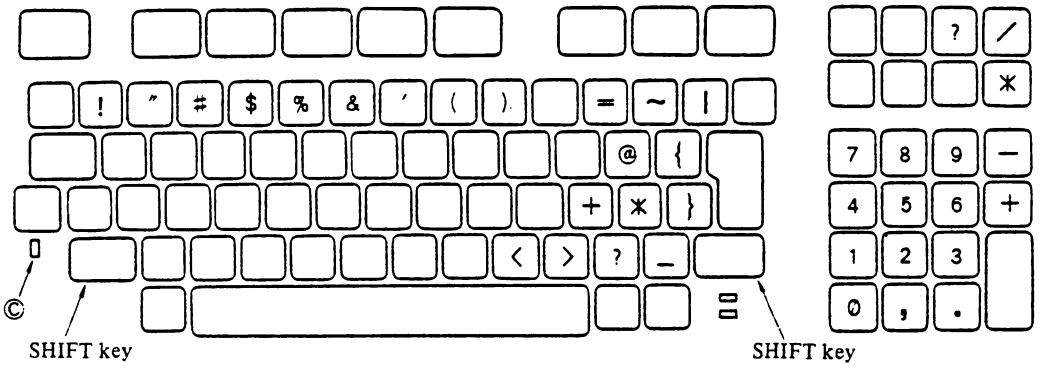
■ **Alphabetic upper case entry mode**

Alphabetic upper case is entered when lamps A , B and C are all out.



■ **Shift mode**

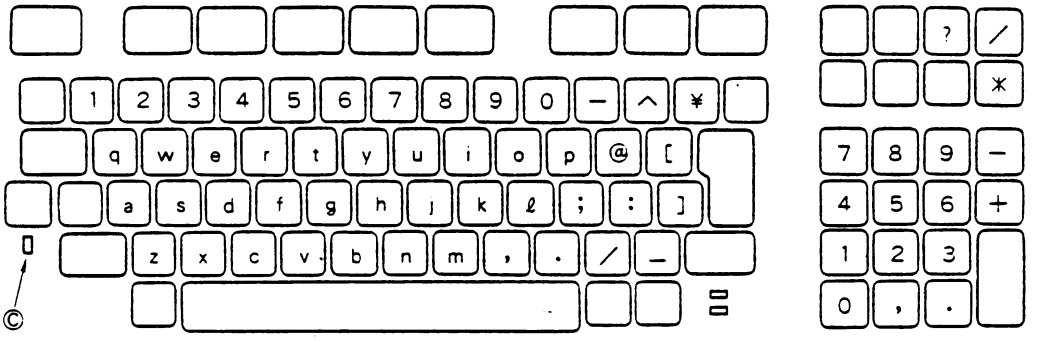
Press and hold down SHIFT key. Press one of the alphanumeric symbol keys for symbol entry. However, when you are entering from the alphabetic section, lower case letters will be entered when the C lamp is OFF and upper case letters will be entered when the C lamp is ON.



When you press the CAPS LOCK (capital lock) key, the C lamp will light red. When the red C lamp is lighted, and a key is pressed along with the SHIFT key, the alphanumeric symbols and alphabetic upper case characters can be entered. If you press the CAPS LOCK key again, the C lamp will go out and a return will be made to the upper case character mode.

■ **Alphabetic lower case entry mode**

When the C lamp is lighted (when the CAPS LOCK key is pressed), alphabetic lower case characters can be entered.



Now, press the [HOME CLS] key at the upper right hand side of the keyboard. When you press this key, the display on the screen will go OFF. Now, press the keys shown below in the sequence shown below. If you make a mistake in pressing these keys, just press the [CLEAR] key once and start the key entry sequence over again.

[S] [C] [R] [E] [E] [N] [1] [1] [0] [ENTER]

This sets the interlace mode. The interlace mode is the mode in which hiragana, etc., is displayed and the mode is entered by the above key entry.

Now press the [カナ ひらがな] key. The A lamp will light in red and the katakana mode will be entered. You can now enter the characters inscribed on the bottom of the keys. If, in this mode, you press and hold the [SHIFT] key and press a character key, you can enter the katakana lower case characters and the kana symbols inscribed on the right side of the keys.

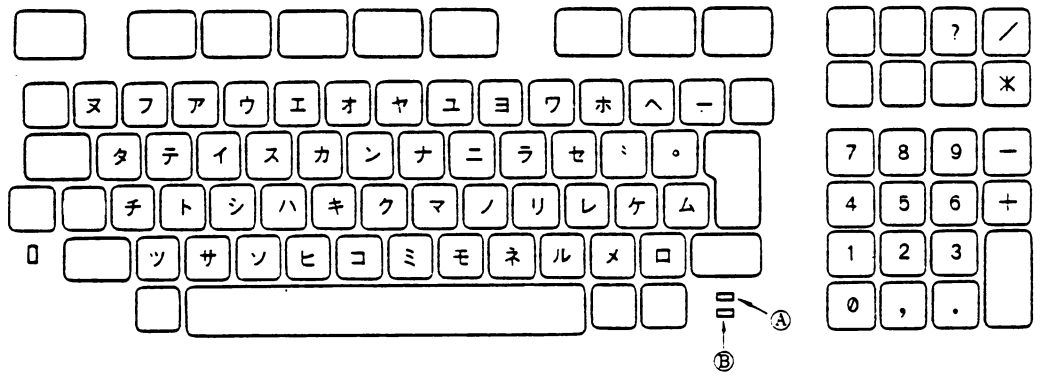
Press the [カナ ひらがな] key again. The A lamp will go out and the green B lamp will light. You can enter the katakana and hiragana inscribed at the bottom of the keys in this mode. When you press one of these keys and the [SHIFT] key, the characters and symbols inscribed at the right hand side can be entered in hiragana. (The symbols are the same as in the katakana mode.)

Then, press the [カナ ひらがな] key again. The B lamp will go out and the system will return to the alphanumeric mode.

■ **Katakana and hiragana entry modes**

When lamp A is lighted, you can enter katakana and kana symbols. When lamp B is lighted, you can enter hiragana and kana symbols.

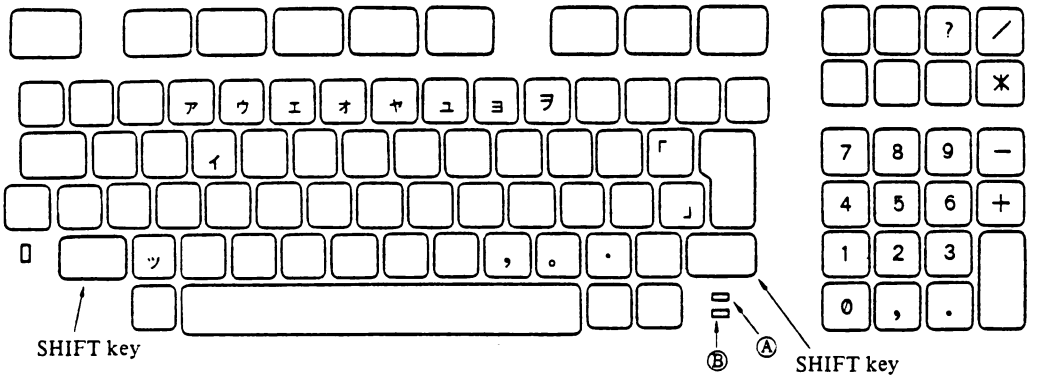
However, you cannot enter hiragana in the non-interlace mode.



■ Katakana and hiragana shift modes

When either lamp A or lamp B is lighted, the SHIFT key is pressed and held, and a key is pressed, you can enter lower case katakana or hiragana and kana symbols, as shown in the diagram below.

However, hiragana cannot be entered in the non-interlace mode.



■ Cautions:

1. You may enter BASIC commands in either alphabetic upper or lower case, but those commands will be processed after being converted to alphabetic upper case.
2. No hiragana input in non-interlace mode.
3. The long key at the bottom is the space bar. It is used to enter spaces no matter what the position of the カナ ひら key or the SHIFT key.
4. There are two SHIFT keys, both of them operate in exactly the same way.

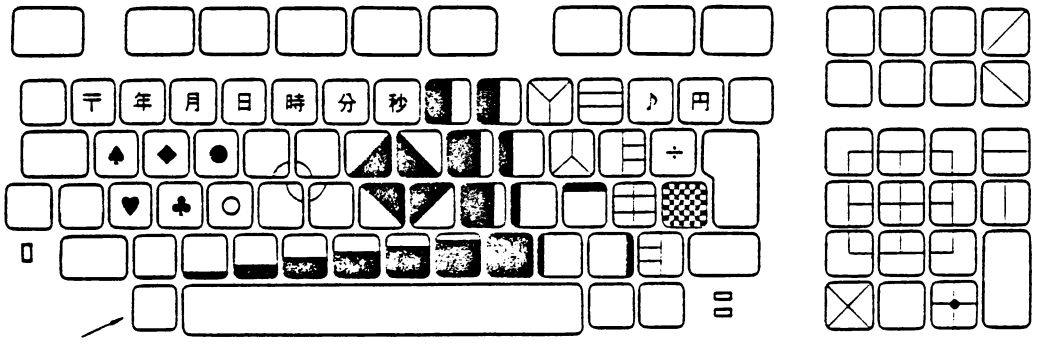
5-2-2 Ten-key Entry

The group of keys at the lower right hand of the keyboard is called the ten-key or ten-key pad. The figures and symbols inscribed on these keys can be entered at any time without any relation to the status of the カナ ひら key and the SHIFT key.

5-2-3 Entering Graphics Symbols

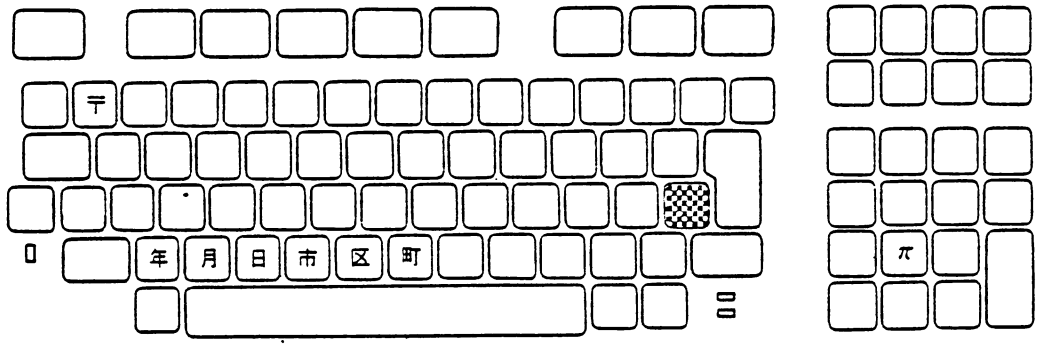
In addition to alphanumeric, katakana, hiragana and symbol input in the MB-S1 Personal Computer Series, you can enter graphics patterns and Kanji by pressing and holding the GRAPH key and then pressing the keys. The differences in the patterns that can be entered in the interlace and non-interlace modes are shown below.

(1) Graphics symbols in the non-interlace mode



GRAPH key

(2) Graphics symbols in the interlace mode



■ Interlace and non-interlace modes are assigned by the following key entry.

Interlace mode	S C R E E N . . 0 ↵
Non-interlace mode	S C R E E N . . 1 ↵

5-3 Description of Return Key

The key indicated by the symbol ↵ is called the return key.
Depress the ↵ key on the keyboard to send the contents of commands displayed on the screen to the main unit. Pressing keys displays the command contents on the screen but does not start operations on those contents in the main unit. When commands are written on the screen, and the ↵ key is then pressed the command contents are sent to the main unit and operations begin on them in the order of entry.
There are two ↵ keys and both function in the exact same way.

5-4 Description of Programmable Function Keys

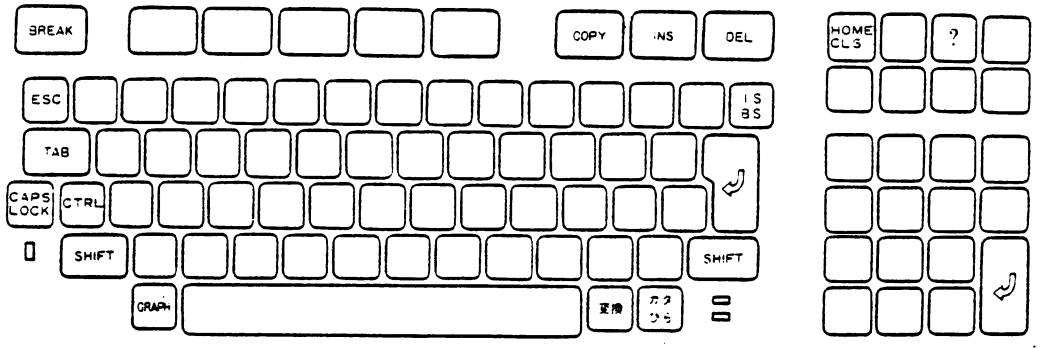
The programmable function keys, or PF keys [PF6 PF1], [PF7 PF2], [PF8 PF3], [PF9 PF4], and [PF10 PF5], are located at the top of the keyboard. A character string (such as a function) is defined for each programmable function keys. An operation which would force you to press a number of different keys every time you wanted to perform the operation can be accomplished by just pressing one key, a programmable function key. The [SHIFT] key can also be used as a PF key, giving you a total of 10 programmable function keys. The contents of each programmable function key have been defined as follows. C_R means that the same operation is performed as if the ↵ key were pressed.

PF1	LOAD C_R	PF6	TERM
PF2	?DATE$, TIME$ C_R	PF7	SCREEN
PF3	KEY	PF8	COLOR
PF4	LIST C_R	PF9	LIST"LPT0:" C_R
PF5	RUN C_R	PF10	CONT C_R

(Note) The entry for keys PF6 ~ PF10 is made by holding the [SHIFT] key down and pressing the [PF6 PF1] ~ [PF10 PF5] key.
You should note that the contents defined for any of the PF keys can be changed by using the KEY command in BASIC. The PF keys also have functions by which you can interrupt a program while it is being run and change the flow of that program. For more details on how to use this procedure, see the BASIC Manual.

5-5 Description of Special Keys

The diagram below shows the keys that are called special keys.



The table on this page lists all the functions of the special keys. The functions of the [convert] key are explained in 5-9 "Description of Convert Key."

Key	Function
 (Break key)	Use to stop the run and processing of a program (Program run and processing can be restarted by using the CONT command.)
 (Escape key)	Not used with BASIC.
 (Katakana/hiragana key)	Assigns modes in this sequence: alphanumeric input mode, katakana input mode, hiragana input mode. Lamps A and B will be out, will light red or light green as the mode requires. A move is made to the next mode every time this key is pressed.
 (Capital lock key)	When you press this key, lamp C will light red. The status has now been set in which you can enter alphabetic lower case characters pressing any key from A to Z. Press the key again and a return will be made to the previous status.
 (Control key)	Use in conjunction with other keys. The functions when this key is used with other keys are explained in 5-7 "Description of Control Key."
 (Shift key)	Use this key in conjunction with other keys. The functions when this key is used with other keys are explained in 5-8 "Description of Shift Keys."
 (Graphic key)	Use this key in conjunction with other keys. For a description of functions when this key is used with other keys, see 5-2-3 "Entering Graphics Symbols."
 (Clear screen/home key)	Press this key to clear the display screen and move the cursor to the home position at the upper left hand corner of the screen. If you press the SHIFT key and this key at the same time, the screen will not clear but the cursor will move to the home position.
 (Print key)	This is the abbreviated form of the PRINT statement which is one of the BASIC commands. Use it when executing calculator functions from the ten-key pad only. (In the example of ? 12 + 34 ↵ , the answer 46 will be displayed) The key can also be used for the standard "?" symbol.
 (Return key)	Pressing this key ends the input of a required program or data unit. The cursor moves to the beginning of the next line.
 (Backspace/insert space key)	Press this key alone and the character or symbol to the left of the cursor will be deleted and all characters to the right of the cursor will be moved one space to the left (backspace). Press the SHIFT key and this key at the same time and a space will be inserted directly to the left of the cursor (insert space).

Key	Function
INS (Insert key)	Pressing the INS key sets the insert mode so that every time a character key is pressed, the characters to the right of the cursor will be moved to the right and a character will be entered into the space indicated by the cursor. The form of the cursor in the input mode will change from ▁→■ . Press the INS key again to clear the insert mode.
DEL (Delete key)	Press the DEL key to delete the character above the cursor. This moves all characters to the left of the cursor one space to the left.
TAB (Tab key)	Press the TAB key to move the cursor to the next tab location.
COPY (Copy key)	Press the COPY key to output what is now displayed on the screen to the printer. By using combinations of GRAPH key and SHIFT key depression with the COPY key, you can select the following three types of hard copy from the printer. COPY ..... An overlapped print of character and graphics screens. GRAPH + COPY ..... A print out of the graphics screen only. SHIFT + COPY ..... A print out of the character screen only. Only the character screen can be copied if the printer you have connected is the MP-1020, MP-1052 or MP-1053.

5-6 Description of Cursor Control Keys

The ↑, ↓, ←, → keys located above the ten-key pad are called the cursor control keys. Pressing any one of these keys will move the cursor in the direction indicated by the arrow.

Key	Function
↑ (Cursor up key)	Press this key to move the cursor up one line. If the cursor is at the top line of the screen and this key is pressed, the cursor will be moved to the screen's final line.
↓ (Cursor down key)	Press this key to move the cursor down one line. If the cursor is at the bottom line of the screen and this key is pressed, the cursor will be moved to the screen's top line.
← (Cursor left key)	Press this key to move the cursor one space to the left. If the cursor is at the left edge of the screen and this key is pressed, the cursor will be moved to the right edge and one line above.
→ (Cursor right key)	Press this key to move the cursor one space to the right. If the cursor is at the right edge of the screen and this key is pressed, the cursor will be moved to the right edge and one line down.

5-7 Description of Control Key

The CTRL (control) key has the functions shown in the table below when used in conjunction with the keys listed (press and hold the CTRL key and press the other key).

- **Caution:** The CTRL key is used in combination with the PF6/PF1, PF7/PF2 or PF8/PF3 key for screen selection when the MPC-VS01S Video Superimpose Card is installed. If the MPC-VS10S is not installed, and you press and hold the CTRL key and press the PF6/PF1, PF7/PF2 or PF8/PF3 key, the system will be unable to perform normal screen display.

CTRL +	Function	Control Code* (hexadecimal)	Keys Providing Equivalent Functions
B	Moves cursor one word to the left.	02	SHIFT + ←
E	Deletes the remainder of the line following the cursor.	05	———
F	Moves the cursor one word to the right.	06	SHIFT + →
G	Emits the bell tone.	07	———
H	Deletes the character at the cursor location.	08	IS BS
I	Moves to the next horizontal tab.	09	TAB
K	Moves the cursor to the home position (upper left corner).	0B	SHIFT + HOME CLS
L	Deletes the screen and moves the cursor to the home position.	0C	HOME CLS
M	Return.	0D	↵
R	Inserts a space.	12	SHIFT + IS 3S
T	Sets horizontal tabs.	14	———
U	Specifies and clears the insert mode.	15	INS
Y	Clears the horizontal tabs.	19	———
Z	Deletes the entire screen from the cursor to the right and below.	1A	———
¥	Moves the cursor one space to the right.	1C	→
]	Moves the cursor one space to the left.	1D	←
^	Moves the cursor one line up.	1E	↑
_	Moves the cursor one line down.	1F	↓
C	Cancels program run (restart by CONT).	03	BREAK
O	Forcible cancellation of program run.	04	———
S	Places a pause on screen output (restarted by pressing another key)	13	———

* The control key can also function to run programs by using the BASIC CHRS function and PRINT command.
This does not apply to control codes 03, 04 and 13 (hexadecimal).

5-8 Description of Shift Keys

The methods of using the SHIFT key were partially described in 5-2 "Key Entry Methods," but it also has the functions listed in the table below when used in conjunction with the cursor control keys.

SHIFT +	Function
Alphanumeric mode + Ordinary input key	Entry of alphabetic lower case and symbols (a, b, c, !, #, etc.)
Katakana mode (red A lamp lighted) + Ordinary input key	Entry of katakana lower case and kana symbols (ｧ, ｳ, ｪ, 「, 」 etc.)
Hiragana mode (green B lamp lighted) + Ordinary input key	Hiragana lower case and kana symbols (ぁ, ぅ, ぇ, ゛, ゜, etc.)
→	Moves the cursor to the beginning of a character string on the right side.
←	Moves the cursor to the end of a character string on the left side.

5-9 Description of Convert Key (System Mode A only)

Katakana and hiragana can be directly entered from the keyboard in the MB-S1 System as described in 5-2-1, but the 変換 (convert) key can also be used in system mode A to convert roman letter entry into katakana or hiragana.

Press the 変換 (convert) key. Lamp A goes out. The blink mode of the cursor will change as follows.

When the first mode is standard blink, the blinking will stop.

When the first mode is stop blink, the standard blinking will start again.

If in this status, you enter the alphabetic upper case letters

K A T A K A N A

The output to the screen will appear as

カ タ カ ナ

(conversion from roman letters to katakana mode).

Press the 変換 (convert) key and then press the カナ/ひら key. Lamp B will light. Now enter the letters

H I R A G A N A

and the output to the screen will appear as

ひ ら が な

(conversion from roman letter to hiragana mode).
The conversion from roman letters to hiragana is valid only in the interlace mode.
Press the [変換] (convert) key again and the conversion mode will clear.

■ **Caution:** The roman letters entered at this time will not be displayed on the screen.

5-9-1 Conversion Sequence

Except for the difference in lamp A and lamp B the sequence of conversion from roman letters to katakana or from roman letters to hiragana when the [変換] (convert) key is pressed is exactly the same.

(1) When lamp A is lighted: Convert roman letter input to katakana.
(2) When lamp B is lighted: Convert roman letter input to hiragana (only in the interlace mode).
(3) When lamps A and B are lighted: Roman letters are entered as is.
(4) When lamp C is not lighted:
When lamp C is not lighted (the [CAPS LOCK] key is not pressed down), roman upper case letters are entered and converted to katakana/hiragana upper case.
(5) When lamp C is lighted:
When lamp C is lighted (the [CAPS LOCK] key is pressed down), roman lower case letters are entered and converted to katakana/hiragana lower case letters.
(6) Shift mode:
When the [SHIFT] key is pressed and held down and roman letters are entered, you can reverse the modes (4) and (5) above.
(7) When entering other than roman letters:
1 There will be no conversion if the characters entered are other than roman letters (characters other than those shown in 5-9-2 "Conversion Table"). If such an entry is attempted, you will be notified by a warning beep tone. Then, make the entry correctly.
2 If the key being entered is other than a character key (such as the [HOME CLS] key) the conversion will be made as shown in this example.

Example: If you are entering SHI so it will be converted to [シ], and you make a mistake and hit the [HOME CLS] key.

[S] [H] [HOME CLS] [I]

The entry of the [HOME CLS] key deletes the screen and only the 「I」 that was entered at last is valid. Instead of getting SHI「シ」you get a conversion of I「イ」.

5-9-2 Conversion Table

The conversion of roman letters to katakana is as shown in the following conversion table. The conversion will be to hiragana if you are in the romal-letter-to-hiragana conversion mode.

Alphabetic Upper Case Entry Conversion Table

Step / Line	ア	イ	ウ	エ	オ	Step / Line	ア	イ	ウ	エ	オ
ア	A	I	U	E	O	ア					
カ	KA	KI	KU	KE	KO	カ	CA		CU QU		CO
サ	SA	SI	SU	SE	SO	サ		SHI			
タ	TA	TI	TU	TE	TO	タ		CHI	TSU		
ナ	NA	NI	NU	NE	NO	ナ					
ハ	HA	HI	HU	HE	HO	ハ			FU		
マ	MA	MI	MU	ME	MO	マ					
ヤ	YA	YI (イ)	YU	YE	YO	ヤ					
ラ	RA	RI	RU	RE	RO	ラ	LA	LI	LU	LE	LO
ワ	WA	WI (イ)	WU (ウ)	WE (エ)	WO (ヲ)	ワ					
ン	NN					ン					
キャ	KYA	KYI	KYU	KYE	KYO	キャ					
シャ	SYA	SYI	SYU	SYE	SYO	シャ	SHA		SHU	SHE	SHO
チャ	TYA	TYI	TYU	TYE	TYO	チャ	CHA CYA	CYI	CHU CYU	CHE CYE	CHO CYO
ニャ	NYA	NYI	NYU	NYE	NYO	ニャ					
ヒャ	HYA	HYI	HYU	HYE	HYO	ヒャ					
ミャ	MYA	MYI	MYU	MYE	MYO	ミャ					
リャ	RYA	RYI	RYU	RYE	RYO	リャ	LYA	LYI	LYU	LYE	LYO

Line \ Step	ア	イ	ウ	エ	オ	Line \ Step	ア	イ	ウ	エ	オ
ガ	GA	GI	GU	GE	GO	ガ					
ザ	ZA	ZI	ZU	ZE	ZO	ザ		JI			
ダ	DA	DI	DU	DE	DO	ダ					
バ	BA	BI	BU	BE	BO	バ					
パ	PA	PI	PU	PE	PO	パ					
ギャ	GYA	GYI	GYU	GYE	GYO	ギャ					
ジャ	ZYA	ZYI	ZYU	ZYE	ZYO	ジャ	JA JYA	JYI	JU JYU	JE JYE	JO JYO
ヂャ	DYA	DYI	DYU	DYE	DYO	ヂャ					
ビャ	BYA	BYI	BYU	BYE	BYO	ビャ					
ピャ	PYA	PYI	PYU	PYE	PYO	ピャ					
ファ	FA	FI		FE	FO	イェ				YE	
ヴァ	VA	VI		VE	VO	クヮ	QWA (クワ)				
クァ	QA	QI QWI	QWU	QE QWE	QO QWO	グヮ	GWA (グワ)	GWI	GWU	GWE	GWO
ツァ	TSA	TSI		TSE	TSO	ヴ			VU		

■ **Caution:** There are a number of different ways for romanizing kana. For example, 「シャ」 may be represented by either SYA or SHA, and 「ジャ」 by ZYA, JA or JYA. All of these different romanization methods will be converted into the correct kana form.

Alphabetic Lower Case Entry Conversion Table

Step / Line	ア	イ	ウ	エ	オ	Step / Line	ア	イ	ウ	エ	オ
ア	a	i	u	e	o	ア					
タ			tu			タ			tsu		
ヤ	ya		yu		yo	ヤ					

Exceptions

(1) With the exception of the consonants "NN" and those shown in (2) for indicating kana symbols, two alphabetic consonants (letters other than A, I, U, E and O) together will be converted to lower case kana「ッ」or「っ」.
Example:

H O	K K A	I	D O	U
↓	↓	↓	↓	↓
ホ	ッカ	イ	ド	ウ

(2) Kana symbol entry

「	(left half-bracket)	XL
」	(right half-bracket)	XR
、	(half stop)	XC
。	(full stop)	XP
・	(mid-point)	XD
ー	(long vowel sign)	XB
゛	(dakuten)	XF
゜	(handakuten)	XH

Example:

X L	H A	X H	X B	S O	N A	R U	X R
↓	↓	↓	↓	↓	↓	↓	↓
「	ハ	゜	ー	ソ	ナ	ル	」

5-10 Auto-Key Repeat and Advance Key-Entry

5-10-1 Auto-Key Repeat

Certain keys on the keyboard can be pressed down and the character for that key will be repeated as long as you hold the key down. We call this the auto-key repeat function.
Use this function when you want to make a serial entry of a particular character.

5-10-2 Advance Key-Entry

Advance key-entry is what we call the function in which an entry is made during program run, the main unit receives the entry but the entry does not appear on the screen.
An advance key-entry of up to 30 characters can be made in the MB-S1 Systems. If you press [BREAK] , [CTRL] + [C] or [CTRL] + [D] , or if you press the RESET switch, the contents of any advance key-entry that has been made at the time you press those keys, or the switch, will be cancelled.
If you are executing a command that requires key entry, such as BASIC's INPUT command, advance key-entry characters will be used in the program in the sequence in which they have been entered.
Note that operations may not be normal if peripheral devices are in operation when an advance key-entry is made.

Section 6. System Mode A (S1 BASIC)

This section gives an overview of system mode A and S1 BASIC, the programming language used in system mode A.

6-1 Screen Modes

6-1-1 Graphics Mode

When system mode A is started up, the screen is set for the graphics mode in which both graphics and characters can be displayed.

(1) Graphics display

The graphics display has two modes of resolution, one with 640 horizontal by 200 vertical dots, the other with 320 horizontal by 200 vertical dots. A full-color dot graphics format is used which gives color to each dot. The graphics display is both colorful and finely detailed.

(2) Character display

There are two displayable character configurations, the 80 character mode with 25 lines of 80 characters each and the 40-character mode with 25 lines of 40 characters each. Each character can be given a particular color. Thus, you can select four types of screen mode using combinations of these graphics display and character display modes.

Screen Mode List (screen mode A, graphics mode)

Graphics Display	640 dots x 200 dots		320 dots x 200 dots	
Character Display	40 characters x 25 lines	80 characters x 25 lines	40 characters x 25 lines	80 characters x 25 lines
Smallest graphics unit that can be colored	1 dot			
Smallest character unit that can be colored	1 character			
Number of graphics screens	1 page	1 page	2 pages	2 pages
Maximum memory size usable in BASIC	36K bytes (132K bytes with expansion RAM)			

Since a separate screen memory is used in the graphics mode for graphics display and character display, you can display overlapped graphics and character screens.

6-1-2 Text Mode

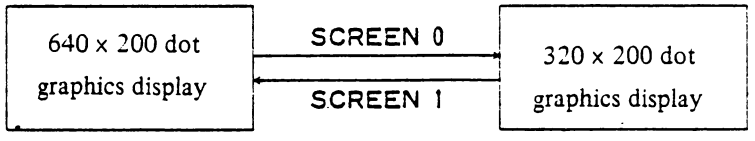
System mode A has a text mode in addition to the screen modes described in 6-1-1 "Graphics modes." Use the text mode to restrict the screen display to characters only. This allows the memory normally used for graphics display to be used for program storage. Using the text mode with programs that require only character display will expand the user area and give more efficient memory use.
The two character screen configurations in the text mode are 25 line by 80 character and 25 line by 40 character.

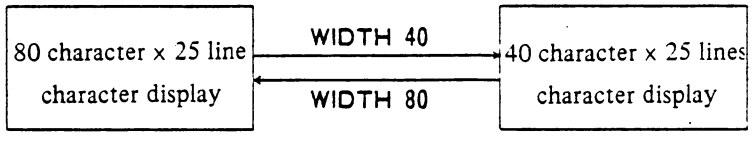
User Area (with standard RAM)

Graphics Mode	Text Mode
36K bytes	84K bytes

6-2 Initialization and Changing Screen Modes

When system mode A is started up, the screens assigned in the graphics mode are the 640 dot by 200 dot graphics display and the 40 character by 25 line character display. These values are the initialization values of system mode A.
You can change the screen mode by executing the SCREEN and WIDTH commands in BASIC. To make a change shown by one of the arrows, execute the command indicated by that arrow.





[Example] If you want to change from the 640 x 200 dot graphics display and 40 character x 25 line character display screen mode to the 320 x 200 dot graphics display and 80 character x 25 line character display screen mode, execute

```
SCREEN 0
WIDTH 80
```

* For more information on the SCREEN and WIDTH commands, see the BASIC Manual.

To change from the graphics mode to the text mode, use the NEW ON command.

NEW ON command functions

1. Changes between graphics and text modes.
2. Decides whether to convert hiragana code to katakana code when print codes are output to the printer.

NEW ON Command	Screen Mode	Hiragana-Katakana Conversion
NEW ON 0	Graphics mode	No conversion
NEW ON 1	Text mode	No conversion
NEW ON 2	Graphics mode	Conversion
NEW ON 3	Text mode	Conversion

■ **Caution:** *All programs will be deleted from memory when the NEW ON command is executed.*

6-3 Interlace and Non-interlace

Interlace and non-interlace are the two scanning methods used in the cathode-ray tube when a display is made. The non-interlace mode is assigned when system mode A is started up.

- Interlace ..... Displays one screen in two scans.
- Non-interlace ..... Displays one screen in one scan.

Since the interlace displays characters in an 8-horizontal dot by 16-vertical dot configuration, it is an appropriate method for displaying characters like hiragana that have a lot of curves. But, when a display is made in the interlace mode on the C15-B01 RGB Input TV or the C12-2120 Color Display, the screen will flicker.

See the BASIC Manual for a description of the methods of switching from interlace to non-interlace and vice-versa.

6-4 DISK BASIC

You can use DISK BASIC in system mode A by connecting a floppy disk drive. DISK BASIC is BASIC (S1 DISK BASIC) with functions for floppy disk control added to the internal BASIC (S1 BASIC) language.

Floppy Disk Drive		DISK BASIC
Mini-floppy Disk Drive	MP-3560 MP-3550	DISK BASIC MA-S101
Standard Floppy Disk Drive	MP-3660 MP-3630	DISK BASIC MA-S102

Memory sizes using DISK BASIC are different from the memory sizes given in 6-1-1 and 6-1-2 when BASIC is used. For further information, see the operation manual on DISK BASIC.

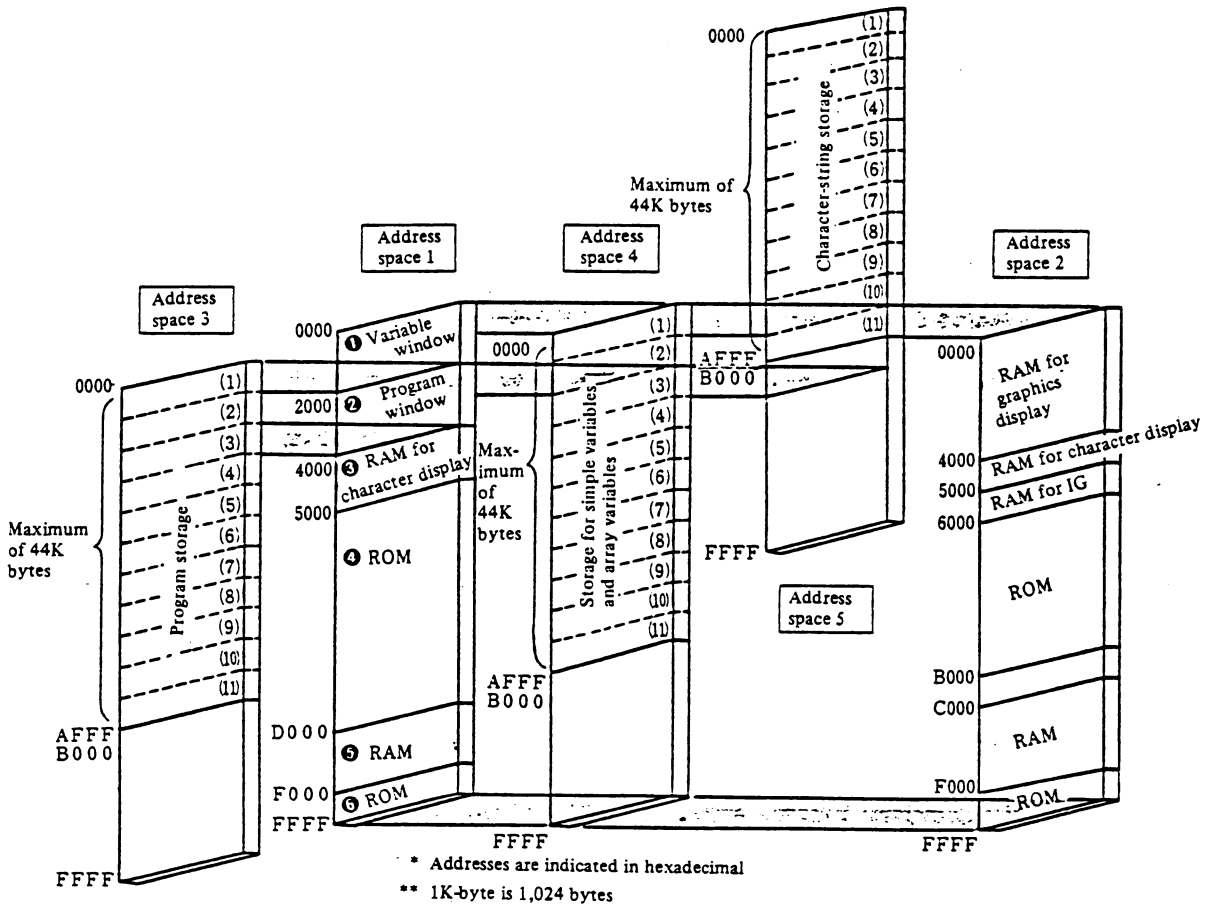
For the DISK BASIC start-up method, see Section 8.

6-5 Memory Map

The description given in this section is somewhat technical, if this is the first time you have read this manual, you need not to read this section. Even if you don't read or understand this section, you can understand the subsequent sections.

The diagram below is a map of the memory in S1 BASIC operations. A program in S1 BASIC has address spaces for the program body, simple and array variables and character strings. These areas are divided into those categories for storage. When a program is executed, the storage areas are referred to through "windows" allocated in address space 1, the basic operating status of S1 BASIC. Address spaces are also assigned in address space 2 for improved processing efficiency when graphics are drawn and musical accompaniment is played.

Usable memory (user memory) in BASIC is 36K bytes (with standard RAM installed). During initialization, 4K bytes are allocated to each area from address space 3 to address space 5. Units of 4K bytes are taken from the remaining 24K bytes and distributed to address spaces 3 to 5 according to what the contents of the input program are.



* Addresses are indicated in hexadecimal

** 1K-byte is 1,024 bytes

(1) **Address space 1**

Address space 1 is the basic memory status (address space of the MPU) during program execution. Programs are referred to through the program window and variables and character strings are referred to through the variable window.

1 Variable window (8K bytes) Addresses 0000 to 1FFF
Simple variables, array variables and character strings are referred to by allocating 8K bytes at a time from address space 4 (simple variable and array variable storage area) and address space 5 (character string storage area) to this area.

2 Program window (8K bytes) Addresses 2000 to 3FFF
The BASIC source program is referred to by allocating 8K bytes at a time from the address space 3 (program storage) to this area.

3 Character display RAM (4K bytes) Addresses 4000 to 4FFF
The RAM area for character display.

4 ROM (32K bytes) Addresses 5000 to CFFF
The ROM area for storing S1 BASIC.

5 RAM (8K bytes) Addresses D000 to EFFF
The area for work and system stacks in BASIC.

6 ROM (4K bytes) Addresses F000 to FFFF
The ROM, system I/O and interrupt vector area for storing system supervisory programs such as hardware interrupt and software interrupt.

(2) **Address space 3 (user area)**

The area which stores the BASIC source program. This area is divided into blocks of 4K bytes each and the BASIC program refers to these areas through the program window in address space 1.

Memory size of address space 3

28K byte maximum with standard RAM
44K byte maximum with expanded RAM

(3) **Address space 4 (user area)**

This area stores simple and array variable data defined in the BASIC program. The area is divided into blocks of 4K bytes each and the BASIC program refers to these blocks through the variable window in address space 1.

Memory size of address space 4

4K byte minimum/28K byte maximum with standard RAM
4K byte minimum/44K byte maximum with expanded RAM

(4) **Address space 5 (user area)**

Address space 5 stores the character strings assigned to character and array variables that are defined by the BASIC program. The area is divided into blocks of 4K bytes each and BASIC refers to the area through the variable window in address space 1.

Memory size of address space 5

4K byte minimum/28 byte maximum with standard RAM

4K byte minimum/44K byte maximum with expanded RAM

(5) **Address space 2**

Processing efficiency of graphics drawing and musical accompaniment is improved by the switching of the MPU address space from address space 1 to address space 2.

(6) **Memory size in the text mode**

The graphics display RAM can be allocated to address spaces 3 to 5 in the text mode (see 6-1-2). That increases the user area during the text mode to these sizes.

Standard status	84K bytes
Expanded RAM	132K byte maximum

Screen Mode	User Area Memory Size		
	Standard Status	64K Byte RAM Expansion	128K Byte RAM Expansion
Graphic Mode	36K bytes	100K bytes	132K bytes
Text Mode	84K bytes	132K bytes	–

■ **Caution:** The user area of S1 BASIC has a maximum memory size of 132K bytes. This applies to both graphics and text mode.

● **Explanation**

(1) S1 BASIC is stored in a 64K byte ROM, but, as the memory map (address space 1) shows, only 32K of the MPU address space (64K byte) is allocated to the area. Using the address mapping method given in 12, "System Description," smooth processing is performed by allocating, at the right time, the portion of ROM required for BASIC processing to the 32K byte area (5000 ~ CFFF).

(2) A method is used similar to (1) in which only the area required for storing BASIC source programs, variables and character strings is allocated to the program and variable window areas to increase the size of the user area.

(3) Address space 2 can also have the configuration shown in the memory map by using the address mapping method given in Section 11, "System Description," and allocating the required memory area to the MPU address space at the right time.

6-6 System Mode A Specifications

The following is a list of specifications for system mode A.

- **ROM** — 64K bytes (S1 BASIC)
  4K byte (character font)
- **RAM** — 48K bytes (program storage, BASIC work, etc.)
  6K bytes (for IG display, 2K bytes x 3 planes)
  48K bytes (for graphics display)
  4K bytes (for character display)
- **Display**

  Character display configuration
  80 characters x 25 lines (2000 characters)
  40 characters x 25 lines (1000 characters)

  Display colors
  15 (red, green, blue, yellow, magenta, cyan, white, in two tones each, and black)

  Graphics display configuration
  640 dots horizontal x 200 dots vertical
  320 dots horizontal x 200 dots vertical

  Graphics color units
  1 dot

  Color pallette
  Select 8 of the 15 colors

  Image generator
  Number of user defined patterns: 256 maximum
  Character configuration: 8 dots horizontal x 8 dots vertical
  Color unit: 1 dot
- **System software** — S1 BASIC

Section 7. How to Use the Cassette Recorder

If power to the main unit were to be turned OFF, the entire program entered into its memory would be erased. To use that program again you would have to do the entry all over again from the beginning. To prevent that from happening, the programs in the MB-S1 system are recorded (written) on tape just as you would record music on a cassette tape. The MB-S1 also functions so that programs written on tape can be entered into the system.

Writing a program from the system on to tape is known as saving the program and entering a program into the system from the recorder cassette tape is called loading the program. This section describes the methods for operating the cassette recorder and loading and saving programs.

Loading and saving through the use of cassette tape can be done in both system mode A and system mode B. First, make sure that you've correctly connected the recorder to the system as described in 3-3 "Connecting the Cassette Recorder."

7-1 Program Load

7-1-1 How to Load a Program (LOAD)

The command which sends (transfers) a program from the cassette recorder to the system is the LOAD command. The system's use of the LOAD command to play (read) the program is called "loading the program."

(1) Always check the following three points before program loading.
   i) Is the system in BASIC command input wait status?
   ii) Is a program already in memory?
   iii) Is the baud rate correct? (see 7-1-5 "Program Transfer Speed")

(2) After checking to make sure that the cassette recorder is connected correctly, insert the cassette tape, fully rewind it, and then press PLAY until you are at the program location.

   If the tape does not move during this operation, remove the remote terminal on the cassette recorder once and then perform the operation again. Then reinsert the remote terminal again. If the cassette recorder has a volume adjustment for play, adjust the play level.

(3) Check the program name. Programs written on tape must have names (file names). When the program name is TEST, key in LOAD "TEST" and press the play button.

   LOAD "TEST" [↵]

   You must press the [SHIFT] + [:] keys before and after the file name.

(4) The message "Searching" will appear on the screen. That means that the system is searching for the program it wants and when the program is found,

```
Found: TEST
```

will be displayed and the program load will begin. When the load is complete,

```
Ready
```

will appear on the screen. If the remote terminal is connected, the tape will automatically stop at this point. (If the remote terminal is not connected, press the cassette recorder's stop button.) This ends the load.

(5) If during the load the message

```
Device I/O Error
```

appears on the screen, the tape will stop. If the message "Found" is not displayed, perform all operations over again from step (1). Make sure that your adjustment of play volume level is correct.
For further details, see 7-1-3 "Volume and Tone Controls."
If the program does not load even after all these steps have been performed correctly, check all connections again. (The connections for write and read may be reversed.)

7-1-2 How to Use Remote Control

(1) Connecting the cassette cable to the remote terminal allows the cassette recorder motor to be controlled. The cassette recorder motor turns when the SAVE (for writing programs on cassette) and LOAD (for reading the program from the cassette) commands are executed. The motor is stopped when the LOAD or SAVE command end. Thus, connecting the remote terminal prevents the recorder motor from moving even if the play, record, fast-forward or rewind button on the recorder is pressed. When the remote terminal is connected, use the BASIC commands MOTOR, MOTOR ON and MOTOR OFF to operate the cassette recorder. Write and read programs with the remote terminal connected.

(2) The motor can operate if the cassette cable is not connected to the remote terminal. This is convenient when rewinding the tape or moving it on fast-forward, but cassette recorder control in BASIC assumes a constantly connected remote terminal. We recommend that you perform all computer operations with the remote terminal connected.

■ **Caution:** If you are using a cassette recorder to which the remote terminal cannot be connected, control will have to be performed manually.

(a) Manual operations for save
Press the play button, the record button and then execute the SAVE command.

(b) Manual operations for load
Execute the LOAD command and immediately press the play button.

7-1-3 Volume and Tone Controls

Standard audio cassette recorders such as the TRQ-359 have knobs for adjusting volume and tone. Since the cassette interface in the MB-S1 System is designed specifically for the TRQ-359 Cassette Recorder and the TRQ-1500 and TRQ-2400 Data Recorders, you may not always be able to read a program if you are using another type cassette recorder. If you are unable to read a program, run the tape while adjusting the volume and tone control knobs for play. Use the TRQ-359 with the volume control knob set between 4 and 6 and the tone control knob set between 7 and 10. Use the TRQ-1500 with the volume control set at 0 to 4 in the standard mode (fast speed mode switch OFF) and at 0 to 2 in the fast speed mode (fast speed mode switch ON).

7-1-4 Recording Characteristics

There is no need to adjust the TRQ-359, TRQ-1500 and TRQ-2400 since they have functions that automatically set the correct recording level. But when using recorders with record-level controls, adjust the recording level, play volume and tone controls at the same time that you adjust the playable range so that program read-write will always be correct.
The slight differences in the writing functions of the TRQ-359 Cassette Recorder and the TRQ-1500 and TRQ-2400 Data Recorders require that you make selections with the dip switch (SW1) on the main unit's back panel as shown in item (1) in 11-4 "Setting the Dip Switch."

7-1-5 Program Transfer Speed

Cassette recorders have one input and one output terminal and use the FSK method to transfer programs and data. The speed of transfer is known as the baud rate. The baud rate is the number of "meaningful data" that can be transmitted in one second. The MB-S1 System has three baud rates of 600, 1200 and 2400 baud all selectable by BASIC command. Programs of the same length run at 1200 baud can be run in half the time at 600 baud. However, the baud rate for save and load must be the same. A program saved at 600 baud cannot be loaded at 1200 baud or 2400 baud and a program saved at 1200 or 1400 baud cannot be loaded at 600 baud.

- **System mode A (600/1200/2400 baud rates)**
  (a) 1200 baud mode
  When the power is turned ON or the RESET switch is pressed, the 1200 baud mode is automatically set in system mode A.
  The 1200 baud mode can also be set by executing this command.

```
MOTOR , 1 ↵
```

(b) 600 baud mode

Execute this command to set the 600 baud mode.

```
MOTOR , 0 ↵
```

(c) 2400 baud mode

Execute this command to set the 2400 baud mode.

```
MOTOR , 2 ↵
```

[Note] The numerics (0 ~ 9, A ~ F) following &H in the command are hexadecimal.

■ Caution:
1. Set the same baud rate for write and read.
2. Use the same cassette recorder for write and read.
3. Always use AC drive because the batteries in a battery driven cassette recorder will drain and cause abnormal operations in read.
4. The TRQ-359 Cassette Recorder and TRQ-2400 Data Recorder may not read correctly in 2400 baud mode. The 2400 baud mode works best with the TRQ-1500 Data Recorder.
5. If you are using the TRQ-359 Cassette Recorder, set the dip switch (SW1) on the rear panel of the main unit according to the instructions in 11-4 "Setting the Dip Switch."

■ Using the TRQ-1500 Cassette Recorder

The TRQ-1500 Cassette Recorder has a fast-speed play mode. Using this function, can cut load time to half of what it is in standard LOAD. If you are going to use the function, set the registers as shown in the table below, turn the fast-speed mode switch on the TRQ-1500 Cassette Recorder to the ON position and load.

Baud Rate during Write	TRQ-1500 Fast-speed Switch	Register Setting
600 baud	ON	POKE &HFFD7, 4 ↵
1200 baud	ON	POKE &HFFD7, 5 ↵

■ Caution: Fast-speed read can not be used in the 2400 baud mode.

7-2 Program Save

7-2-1 How to Save a Program (SAVE)

The command that sends programs from the MB-S1 system to the cassette recorder is the SAVE command. Input programs can be written on cassette tape by SAVE command and

fetched when needed by LOAD command.
Observe the following cautions during SAVE.

(1) First, check these two points.
   i) Is the system in command input wait?
   ii) Does the program you want to save exist?

(2) Check to make sure cables are correctly connected. Then insert the tape cassette into the cassette recorder and rewind all the way. Press the play button to move the tape forward slightly. This is to avoid the leader on the tape on which nothing can be written. If the tape does not move, remove the cable from the remote terminal. After you have finished the operation, reinsert the cable.
   If you are going to save a program that has already been saved on the tape, run the tape forward until you reach an unwritten location with no programs on it.

(3) Adjust the recording level. This is unnecessary if the cassette recorder has an auto-level adjustment.

(4) Press the record and play buttons. (This sets the recorder for writing.)

(5) Give a name to the program to be saved. If you're saving a program named TEST (file name), key in

```
SAVE "TEST" [↵]
```

   Before entering the file name you must press [SHIFT] + [;] .

(6) When the program save is complete,

```
Ready
```

   will be displayed. If the remote terminal is connected, the tape will automatically stop at this point. If the remote terminal is not connected, press the stop button. This ends the save.

(7) When the key entry in (5) is made and the message

```
Device in use
```

   is displayed, key in

```
CLOSE [↵]
```

   When the cursor is displayed, perform the steps in (5) again.

7-2-2 Checking Results of the Save

The method of saving a program was described in 7-2-1, but it is impossible to know whether or not the program was correctly written by looking at the tape. If you try to load the program to check and find that an error was made and the program wasn't saved, the program will no longer exist; you've lost it. To prevent this from happening, use the LOAD? command to check the results of the program save.
This is done in the following steps.

(1) Rewind the tape all the way as instructed in 7-2-1.

(2) To check whether the program named TEST has been correctly loaded, enter

```
LOAD? "TEST" [↵]
```

   and press the play button.

(3) If the program is correctly written,

```
Ready
```

will be displayed and the tape will stop automatically (if the remote terminal is connected).

(4) If the message

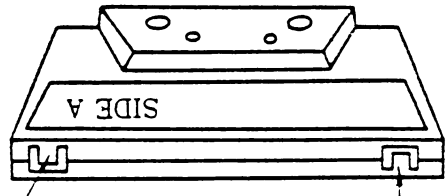
```
Device I/O Error
```

is displayed during cassette operations, enter CLOSE and then repeat the steps from (1) to (3). Don't forget the play-level adjustment.

(5) If you repeat those steps and the message in (4) is still displayed, there is a possibility that the program cannot be saved. So try to save it again. Don't forget the recording level adjustment.
Always use the same recorder for read and record.

7-2-3 Protecting the Program

When saving a program, the cassette recorder begins to write into the tape from the record-head location. Thus, if there is a program already saved on the tape, it will be erased as the new program is written in. To keep important programs from being erased by mistake, use the BASIC SKIPF and LOAD? commands to detect locations where nothing is written. Then start the save operation. You can also protect your programs by bending the write prevention tabs on the cassette.



Write prevention tab (B side)

Write prevention tab (A side)

Section 8. How to Use Floppy Disks

Cassette recorders are widely used for external storage devices in personal computer systems because of their low cost and relative ease of use. However, there are problems using cassette recorders. The two main problems are

(a) Slow speed in load and save, and

(b) They are sequential.

Sequential means that once a file (program or data) is written, it has to be read from the tape in the same order that it was written. The other external storage method for personal computer systems is the floppy disk which does not have the disadvantages of the cassette recorder. The loading of a program that may take several minutes with cassette tape takes only a fraction of that time with floppy disk. The floppy disk also allows you to refer to data just as you would if you were looking something up in a dictionary. To find a word in a dictionary, you don't start at the first page and then turn each page one after another, you go immediately to the page area you want. Load and save with floppy disk can be performed from any point on the disk. That is what is known as random access. This section gives a general description of how to use floppy disks.

For further information, read the operational manual provided with each of the floppy disk drives.

8-1 Inserting the Diskette

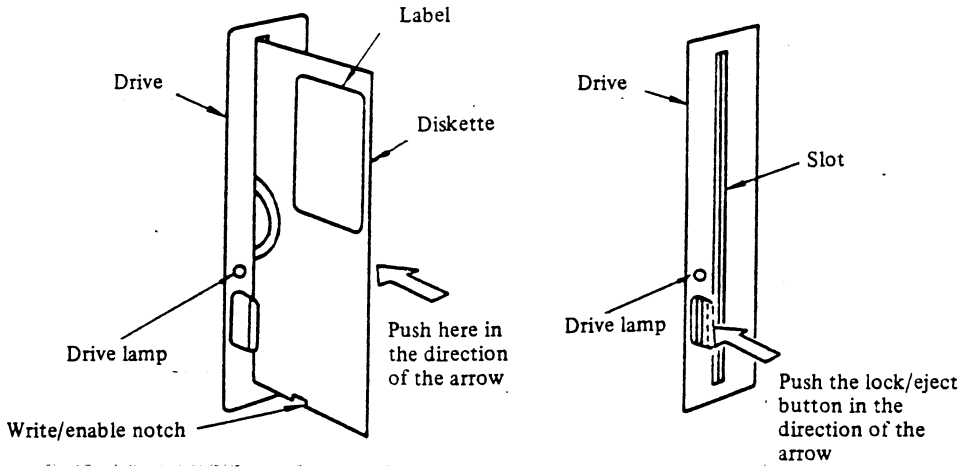
In describing how to insert a diskette in the floppy disk drive, we will use examples with the MP-3560 Mini-floppy Disk Drive connected. The procedure is almost the same for every floppy disk drive.

(1) Connect all peripheral devices to be used according to the instructions in 3 "Connecting Peripherals to the MB-S1."

(2) Hold the diskette so that the write-enable notch is on the bottom and insert the diskette into the drive. Insert the diskette gently. If you turn it at an angle or try to push the diskette with force that can damage the diskette and render it unusable.

(3) Check to make sure that the diskette is all the way into the drive and that it does not go any farther than it is supposed to. If the diskette is correctly inserted, you will hear a click.

(4) Push the lock/eject button on the drive until you hear a click. Do not attempt to close the lock/eject button if the diskette is not completely inserted into the drive. That will damage the diskette.



(Using the MP-4560 Mini-floppy Disk Drive)

■ **Caution:** Check the operation manuals for the MP-3660 and MP-3630 Standard Floppy Disk Drives, the MP-3550 Mini-Floppy Disk Drive and the MP-3370 and MP-3375 Compact Floppy Disk Drives for the respective methods of inserting diskettes.

8-2 Handling Diskettes

Diskettes have a very thin film of magnetic material on their surfaces. They can be damaged from the slightest shock and extreme care must be used when handling diskettes. Always observe the following procedures to prevent important programs from being destroyed.

(1) Always make sure no diskettes are in the drive when inserting or removing power plugs, or turning power switches ON and OFF, on the main unit or the peripheral devices connected to the main unit. If diskettes are left in the drive under these conditions, data can be destroyed.

(2) Do not touch the lock/eject button or try to remove the diskette during access (drive lamp is ON). Not only will this cause data loss, it will damage the read/write heads.

(3) Do not place diskettes near strong magnetic fields such as those generated by radio and TV. This will cause data to be destroyed or make stored contents (programs and data) unreadable.

(4) Do not touch the diskette surface with your hands and do not bend diskettes. Do not attach paper clips to the diskette. Oil from the hands and marks from clips, etc., will render the surface useless for read and write.

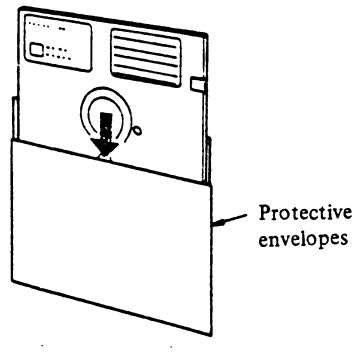
(5) Do not store diskettes in high temperature or high humidity areas. Do not place diskettes anywhere near magnets or magnetic fields. When not in use, place all diskettes in their protective envelopes and store them in a container suitable for storing data media, such as a diskette file box. Do not subject diskettes to rapid changes in temperature.

(6) To protect programs and data that you have stored and do not want erased, affix a write protect seal to the diskette and make sure you do not mistakenly erase data (for mini-floppy diskettes only).

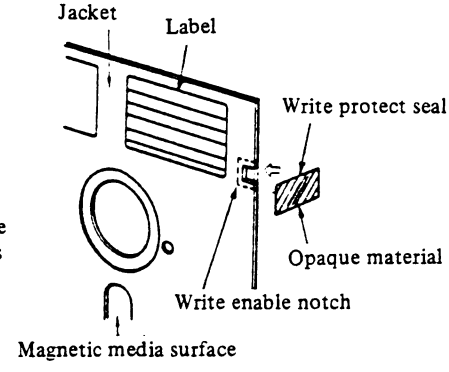
(7) If you are going to write on the labels, use prescribed labels and write on the label before placing it on the jacket. If you write directly on the jacket or if you write on a label that has been attached to the jacket, it could damage the magnetic surface of the medium. Don't try to place an old label on the diskette again. Replace the label with a new one.

Do not use any of the diskette types listed below. They can dirty and damage the drive.

1) Diskettes that are warped, curved or bent, that have cuts in them or have damaged edges.
2) Diskettes that have damaged media surfaces.
3) Diskettes (including the magnetic surface) that have been soiled by viscous liquids such as coffee or carbonated beverages, solvents or metallic powders.



Place diskettes in protective envelopes when not in use



Write prohibit of important diskette

8-3 How to Start Up DISK BASIC

The MB-S1 system can use DISK BASIC (option) programs shown in the table below according to the system mode (system mode A or system mode B) and the floppy disk drive (see 9-1-4 "Floppy Disk Drive") that is going to be used.

Floppy Disk Drive		Usable DISK BASIC
		System Mode A
Mini-Floppy Disk Drive	MP-3560 MP-3550	MA-S101
Standard Floppy Disk Drive	MP-3660 MP-3630	MA-S102

Use the following procedures in starting up DISK BASIC.

(1) Connect the peripheral devices that you are going to use according to the instructions given in 4-1-1 "Turning Power On" and turn the power ON to all units except the main unit.

(2) Follow the procedures in 8-1 and insert the diskette, which stores the DISK BASIC programs supplied with DISK BASIC, into floppy disk DRIVE O.

(3) Check to make sure the diskette is correctly inserted. Now turn ON the power switch on the main unit.

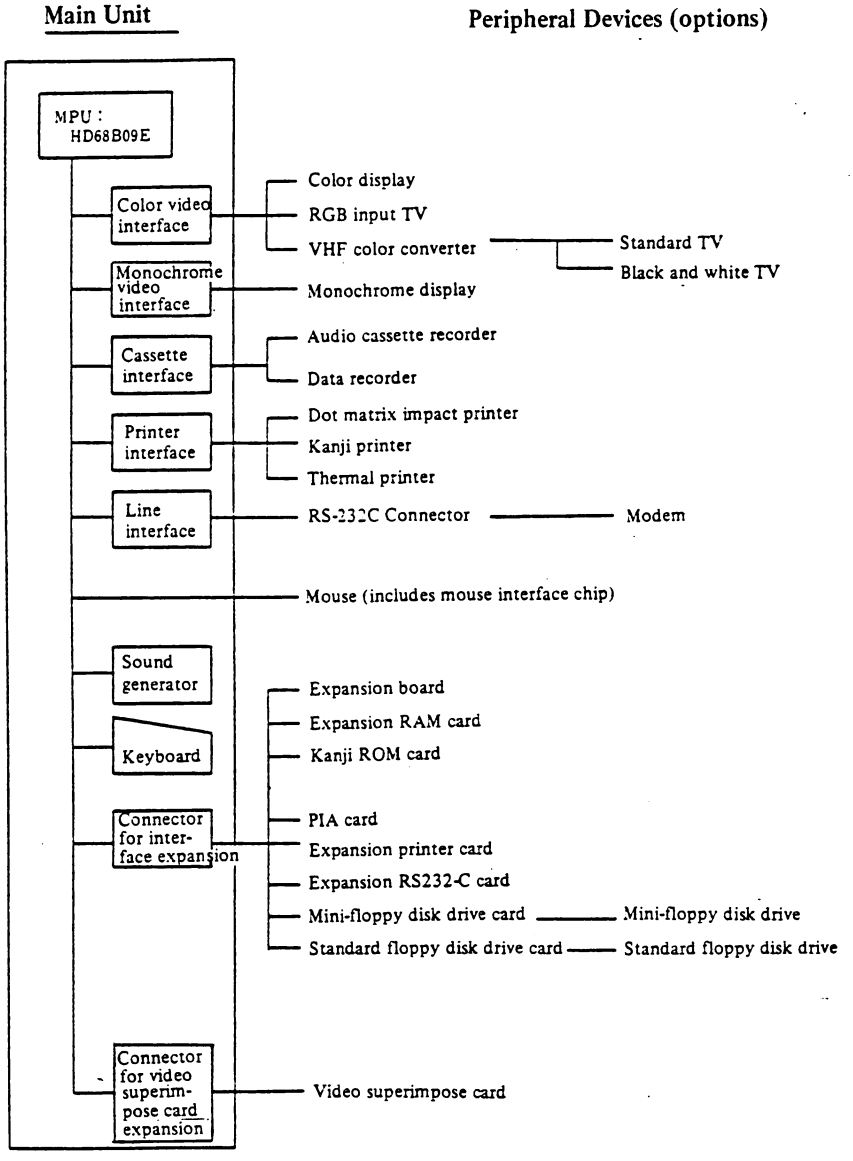
(4) DISK BASIC will be automatically read into the main unit memory. The system will then give the initial display and go into command input wait status.

■ **Caution:**
1. The contents of the display in (4) and the usable user area in BASIC will differ according to DISK BASIC program type.
2. To shut the power OFF, first remove diskettes from all drives and then shut the power OFF to each unit.

8-4 Loading and Saving Programs

To save programs on floppy disk or to load a program saved on floppy disk, use the SAVE and LOAD commands just as you would do with the cassette recorder. For further information, read the manuals for the DISK BASIC program.

The peripheral devices shown in the following chart have been prepared as options for the MB-S1 System. For greater detail on the configuration of each device, see 2-1 "System Configuration Diagram."



9-1 Main Peripheral Devices

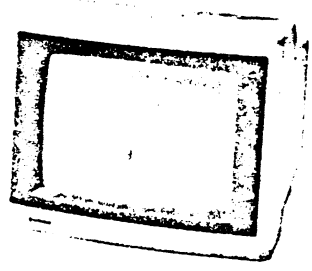
This section looks at the main peripheral devices (options) connectable to the MB-S1 Series and their functions.

9-1-1 Displays

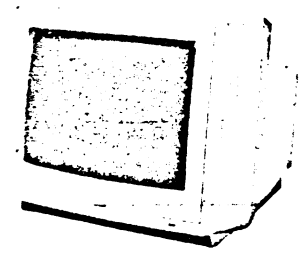
This is the device for screen monitoring of data input and output. The two types of displays are those especially designed to be used only as computer monitors (color and monochrome) and those that can also be used as color TVs. Select the one that you want for the particular way you are going to use it.

Item \ Model Number and Name	C14-1290 C14-2190A Color Displays	C12-2120 Color Display	K12-2070P Monochrome Display	C15-B01 RGB Input Television
Cathode-ray tube	14-inch long-persistence phosphor type	12-inch short-persistence phosphor type	12-inch long-persistence phosphor type	15-inch (0.49 mm pitch)
Number of characters displayable	2,000	2,000	2,000	2,000 matched
Resolution	640 x 400 dots (interlace)	640 x 200 dots	640 x 200 dots (interlace)	–
Colors displayable	15	15	Green (15 tones)	15
Features	• Low screen flicker • C14-2190A designed for Kanji display	• Compact 12-inch • Designed for games and general display	• Compact 12-inch • Low screen flicker, single color green display	• Installation of the MPC-VS01S Video Superimpose Card allows display from the MB-S1 System to be superimposed on VCR, VDP or TV monitor screen
Miscellaneous	• C14-2190A has front filter • Display connector cable attached	• Display connector cable attached	• Display connector cable attached	• Usable as standard color TV • Display connector cable is purchased separately • Input terminals attached for character multiplex broadcasting

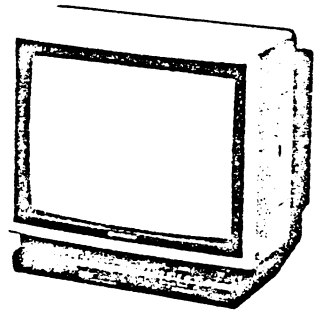
■ **Caution:** Screens on the C12-2120 and C15-B01 will flicker when Kanji are displayed. For Kanji display, use the low-flicker C14-2190 or C14-2190A.



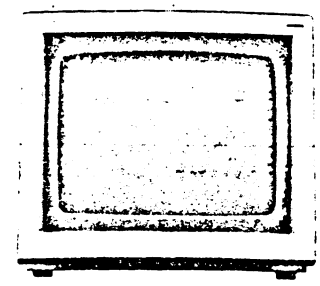
C14-2190A



C12-2120



C15-B01



K12-2070P

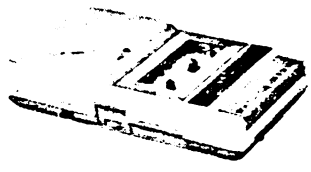
9-1-2 Cassette Recorders

Cassette recorders are (external storage) devices used in personal computer systems to read and write programs and data. The cassette tape used is the same as that sold everywhere for audio recording.

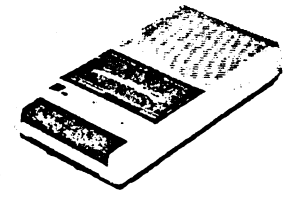
The TRQ-359 Cassette Recorder is a general purpose recorder that can also be used for audio recording and play. The TRQ-1500 and TRQ-2400 Data Recorders were developed especially for use with personal computers.

Model Number and Name / Parameter	TRQ-359 Cassette Recorder	TRQ-1500 and TRQ-2400 Data Recorders
Power	AC/DC Two-power	AC Power
Track Format	2-track monaural	2-track monaural
Control	Remote terminal	Remote terminal
Miscellaneous	For general audio use	For personal computer use

■ **Caution:** Use the TRQ-2400 if you are going to use the 2400 baud rate.
If you are using the TRQ-359, set the dip switch (SW1) on the rear panel of the main unit according to the directions in 11-4 "Setting the Dip Switch."



TRQ-1500

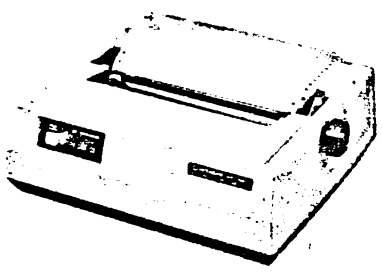


TRQ-2400

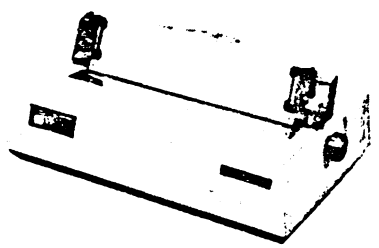
9-1-3 Printers

This is the peripheral device for printing out programs and the results of program processing.

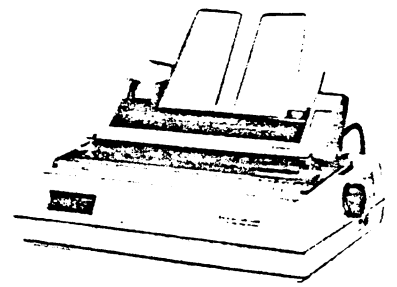
Item \ Model Number and Name	MP-1041, MP-1050 Dot Matrix Impact Printer	MP-1052 16-inch Kanji Printer (16-pin matrix head)	MP-1053 16-inch Kanji Printer (24-pin matrix head)	MP-1020 Thermal Printer
Speed	120 cps	90 cps (standard mode), 60 cps (Kanji mode)	60/120 cps (ANK characters), 83 cps (half-angle characters) 40 cps (Kanji)	70 cps
Print character types	Characters . . . . . 218 types Graphic characters . . . . . 66 types	Characters . . . . . 218 types Graphics characters . . . . . 66 types Kanji . 2,965 types Non-Kanji . . . . . 453 types (JIS Standard No. 1)	ANK characters . . . . . 280 types Half-angle characters . 172 types Kanji . 2,965 types Non-Kanji . . . . . 453 types (JIS Standard No.1)	Characters . . . . . 218 types Graphics characters . . . . . 66 types
Paper	• MP-1041 10-inch sprocket paper or 9 inches or less cut paper • MP-1050 3-16 inch sprocket paper or 15-inch or less cut paper	4- to 16-inch sprocket paper or A4 cut paper	4.5- to 16-inch sprocket paper or A4 cut paper	Hitachi Thermal Roll Paper (216 mm wide)
Features	• High-speed standard printer	• Kanji printer	• High-quality Kanji Kanji print	• Low-noise
Miscellaneous			Auto-shift feeder, simple inserter, JIS Standard No. 2 Kanji ROM as options	



MP-1041



MP-1050

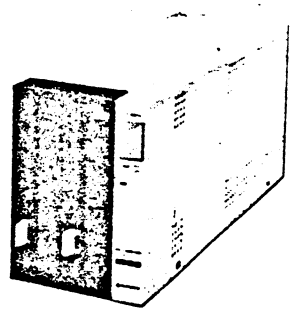


MP-1053
(With separately purchased simple inserter installed)

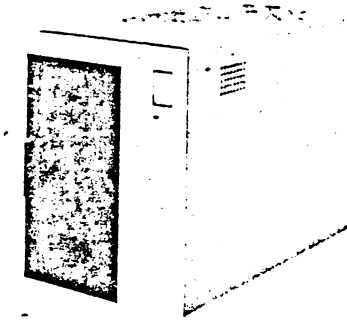
9-1-4 Floppy Disk Drives

The floppy disk drive is an external storage device for storing programs and data. It offers faster input and output of data than the cassette recorder.

Model Number and Name / Parameter	MP-3560, MP-3550 Mini-Floppy Disk	MP-3660, MP-3630 Standard Floppy Disk
Storage capacity	656K bytes/dual drive	2M bytes/dual drive
Storage medium (diskette)	5.25-inch diskette (dual sides, double density)	8-inch diskette (dual-sided, double density)
Number of tracks	40	77
Number of drives	2	2
Transfer speed	250K bits/sec.	500K bits/sec.
Interface card	MP-1870 Mini-floppy Disk Drive Card (provided with the MPC-EX01S Expansion Board A)	MP-1806 Floppy Disk Drive Card (requires MPC-EX02S Expansion Board B)
	MP-1802, MP-1802A Mini-floppy Disk Drive Card (requires MPC-EX02S Expansion Board B)	
Features	• Compact • For a wide range of use from games and hobbies to personal business	• Large storing capacity • For personal business



MP-3560



MP-3660

9-2 Options for System Expansion

Options for versatile system expansion have been prepared allowing you to use the MB-S1 system for a wide range of applications.

Model Number and Name	Contents	Remarks
MPC-RA64S Expansion RAM Card	64K-byte RAM card to increase RAM area size	Up to four can be installed in the main unit (when the MPC-EX01S Expansion Board A is used)
MPC-VS01S Video Superimpose Card	Card installed so that displays from the MB-S1 System can be superimposed on TV, VCR or VDP output screens	Used with the C15B-01 RGB Input TV.
MP-3710 Mouse	The mouse pointer is a device that simplifies personal computer entry	Contains a mouse interface chip
MP-7932 RS-232C Connector	25-pin connector allowing the use of an RS-232C line	Can be used with the RS-232C port (1) in the main unit
MPC-KA01S Kanji ROM Card	ROM card storing the JIS Standard No. 1 Kanji font (standard equipment with the MB-S1/20)	• ROM installed for Kanji dictionary • Optional with the MB-S1/10
MP-9740, MP-9740A Kanji ROM Cards	ROM card storing the JIS Standard No. 1 Kanji font	• Option card for the BASIC-master Level-3 Series • Requires MPC-EX02S Expansion Board B for expansion
MP-1810 Expansion Printer Card	Interface card allowing a second and third printer to be connected.	
MP-1820 Expansion RS-232C Card	Interface card that allows the number of RS-232C ports to be expanded to a maximum of 5. (One port is already installed in the main unit)	
MP-1895 PIA Card	Interface card for installing two PIAs (LSI used for peripheral control)	

■ **Caution:** For the method of using these expansion options, see the manuals that are provided with each option.

Section 10. RS-232 Connector (Option)

By connecting the optional MP-9732 RS-232C connector to the main unit's RS-232C connection attachment, the RS-232C line interface in the main unit can be used for data input/output data with external devices having RS-232C lines.
Only authorized service representatives from the Hitachi personal computer outlet can attach the RS-232C connector to the main unit and check its operations. You can also bring the unit into the outlet where the connector will be attached and check and returned to you. If the connector is attached by any other method or by unauthorized persons, it will affect our quality guarantees.

- **Caution:** 100V AC is applied to many of the locations within the main unit. This presents the danger of electrical shock. Installation of the MP-9732 Connector must be done by an authorized representative from your Hitachi personal computer outlet.

10-1 Setting the Interface Signal

To use the RS-232C lines for data input/output with other devices, the logic of the input/output signals of each RS-232C connector (25-pin) terminal, shown in the table, must match the signal specifications of the other device. The signal logic is set in the main unit. The setting is in standard status of signal logic in the table.
Signal logic of the send data (TxD), send request (RTS), send enable (CTS) and data receive carrier detection (DCD) signals can be changed from standard status. Only authorized service representatives from the Hitachi personal computer outlet can change the RS-232C interface signals.

RS-232C Line Interface Signals

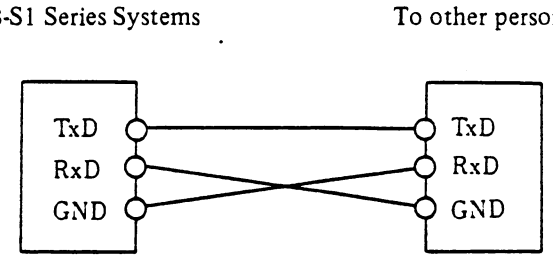
RS-232C Connector Terminal Number	Terminal Name (Signal)	Input/ Output	Function	Standard Set Status	Signal Logic that Can be Changed
2	Send data (TxD)	Output	Data-send signal to external device	TxD*	TxD
3	Receive data (RxD)	Input	Data-receive signal from external device	RxD*	– (unchangeable)
4	Send request (RTS)	Output	Request a start of send to external device	RTS	RTS
5	Send enable (CTS)	Input	Indicates that data can be sent to an external device	GND**	CTS
7	Signal ground (GND)	–	Common ground	GND	–
8	Data receive carrier detection (DCD)	Input	Indicates whether receive data from the external device is valid	GND**	DCD
1, 6, 9 ~ 25	Not connected (NC)	–	–	–	–

* Bars over the top of a signal name such as $\overline{\text{TxD}}$ and $\overline{\text{RxD}}$ indicate that the signal is negative logic.

** CTS and DCD are grounded in standard set status and can always be sent and received by the main unit.

■ **Connecting to personal computer**

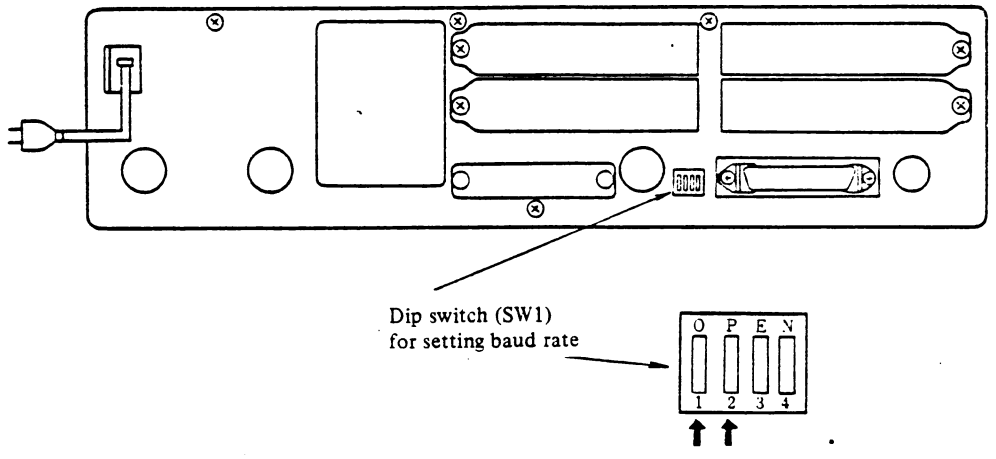
If you are using the RS-232C line, are connected to another personal computer (such as another MB-S1 or a BASIC-Master Level-3 system) and inputting/outputting data by BASIC RS-232C line command, connect RxD, RxD and GND as shown below. RTX, CTS and DCD will not be used at this time, so use the standard status for signal logic.



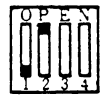
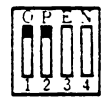
10-2 Setting Baud Rate

If you are using the RS-232C line interface and have external devices connected, the baud rate (data transfer rate) of the receive side and the send side must be the same. Baud rate is set by a combined method of option specifying S or F in the BASIC OPEN and TERM commands, setting the clock divider rate (1/16 or 1/64) and setting the dip switch (SW1)'s 1 and 2 switches on the main unit's rear panel.

Main Unit Rear Panel



■ **Caution:** For further information on the OPEN and TERM commands see the BASIC Manual.

Dip switch Setting	Specification of Clock Divider Rate		Remarks
	S	F	
	300 BPS	1,200 BPS	Setting when shipped from the factory
	600 BPS	2,400 BPS	——
	1,200 BPS	4,800 BPS	——
	2,400 BPS	——	——

Switches 3 and 4 on the dip switch (SW1) have no relation to baud rate. For further information see 11-4 "Setting the Dip Switch."

Section 11. System Description)

This section gives detailed specifications of the physical memory map, system I/O, etc. You may consider the contents of this section to be rather technical and you don't have to understand everything in order to operate BASIC. However, the section will give you a much better understanding of the system's excellent functions.

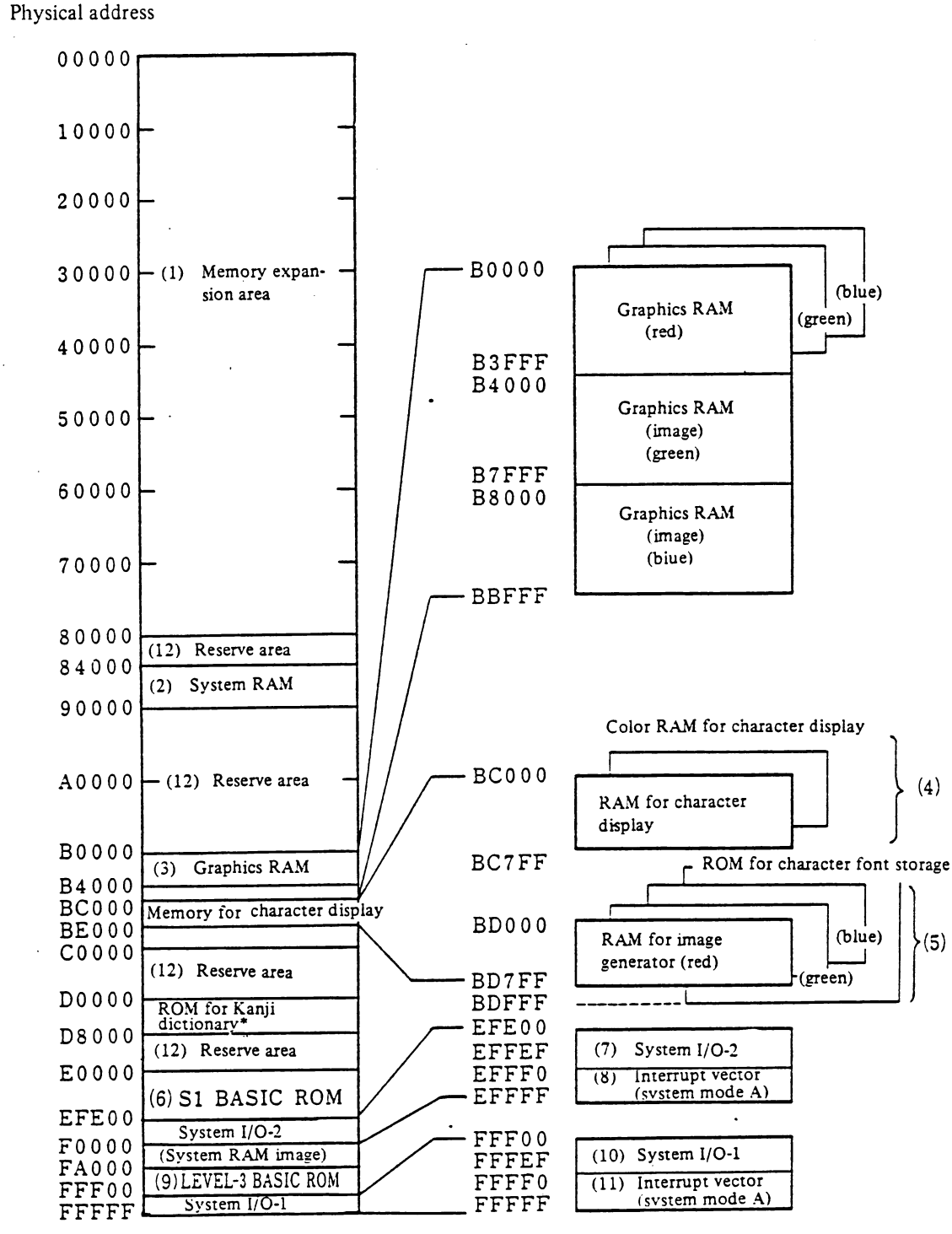
■ **Caution:** The dollar sign ($) is used in this section to indicate figures that are in hexadecimal.

11-1 Physical Memory Map

The memory map used during BASIC operations was explained in 6 and 7, but the memory space actually used in the MB-S1 System is a one-megabyte (1M = 1,048,576 bytes) area with addresses from $00000 to $FFFFF. This area is called the physical memory space. By dividing the area into 4K-byte units and allocating those units to anywhere in the MPU memory space (64K byte) the entire area of 1M bytes is MPU accessible (address mapping method) achieving an epoch-making large memory system with only an 8-bit MPU.

11-1-1 Memory Map

The physical memory space is represented here by a memory map with addresses from $00000 to $FFFFF.



(Note) Addresses are in hexadecimal * Installed in the MB-S1/20 only

11-1-2 Description of Memory Map

This section describes the memory map diagrammed in 11-1-1.

(1) $00000 ~ $7FFFF Memory expansion area
This area is normally vacant, but can be used as a RAM area by installing an expansion RAM card.

(2) $84000 ~ $8FFFF System RAM
A storage area for programs and data. This area is a user area during BASIC operations.

(3) $B0000 ~ $BBFFF Graphics RAM
This is the display RAM area for displaying full-color graphics and 16K bytes (48K byte total) of the RAM are allocated for the three colors red (R), green (G) and blue (B).
This area can also be used as a program storage area in the text mode (when only characters and no graphics are displayed).
* Area $B4000 ~ $BBFFF is an image of the green and blue area.

(4) $BC000 ~ $BC7FF Character display RAM/character display color RAM
RAM for character display (video RAM). Stores character codes and color information.

(5) $BD000 ~ $BDFFF Image generator RAM/Character font storage RAM
Configured from the 4K-byte ROM ($BD000 ~ $BDFFF) that stores the same character fonts (character patterns) as those in the image generators and the 6K-byte RAM ($BD000 ~ $BD7FF) which stores image generator character patterns for the three colors red, green and blue (2K bytes x 3 patterns).

(6) $E0000 ~ $EFDFF S1 BASIC ROM
ROM area that stores the S1 BASIC operated in system mode A.

(7) $EEE00 ~ $EFFEF System I/O-2
The system I/O area for system mode A. Addresses $EFF00 ~ $EFFEF comprise a common area used with system mode B.

(8) $EFFF0 ~ $EFFFF Interrupt vector
ROM area that stores the vector addresses used in system mode A for RESET, hardware interrupt and software interrupt.

(9) $FA000 ~ $FFEFF LEVEL-3 BASIC ROM
ROM area that stores LEVEL-3 BASIC operated in system mode B.

(10) $FFF00 ~ $FFFEF System I/O-1
The system I/O area for system mode B. This is an area commonly used with system mode A.

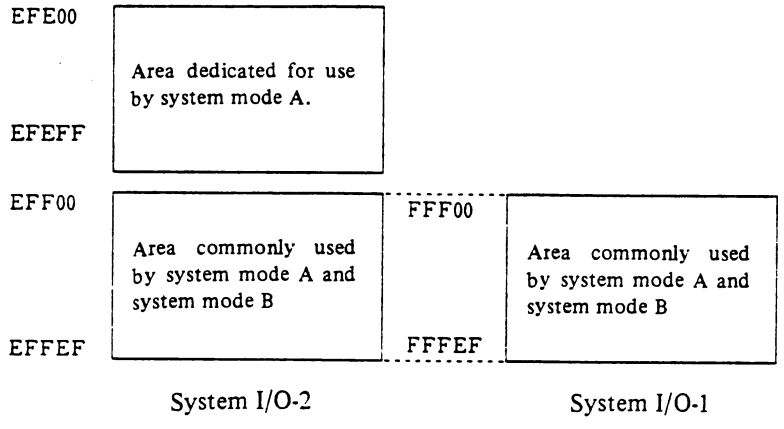
(11) $FFFF0 ~ $FFFFF Interrupt vector
ROM area that stores the vector addresses for system mode B.

(12) $80000 ~ $83FFF, $90000 ~ $AFFFF, $C0000 ~ $DFFFF Reserve areas
These areas are reserved for system expansion. (In the MB-S1/20, the addresses from $D0000 to $D7FFF are used for installing the Kanji dictionary ROM.)

■ Caution: Addresses $F0000 to $F9FFF used as RAM areas in system mode B, become system RAM image areas.

11-2 System I/O (input/output)

Part of the physical memory space in the MB-S1 System is a system I/O area as shown in the diagram below and hardware register addresses are allocated to it for system control. The areas of addresses $EFF00 ~ $EFFEF and $FFF00 ~ $FFFEF are areas commonly used by system mode A and system mode B. However, the area of addresses from $EEE00 ~ $EFEFF are dedicated for use by system mode A.
The addresses of system I/O areas not described in this section are reserve areas for use by option cards.



■ Caution: In the remaining part of this section, the most significant digit of the hexadecimal 5-digit physical hardware register addresses will be omitted and the addresses written in 4 hexadecimal digits.

11-2-1 System I/O in Common Areas

R: Read; W: Write; X: Undefined data during read; X/O: Undefined during read; Write O during write.

Address	Name	Data Bit								R/W	Functions
		D7	D6	D5	D4	D3	D2	D1	D0		
FFC0	PIA-BANK	D7	D6	X/O	X/O	D3	D2	D1	D0	R/W	Standard equipment RAM bank switching register in system mode B (See (1)).
FFC1		O	O	O	O	O	CRA2	O	O	W	
FFC2	PIA	PB7	PB6	PB5	PB4	PB3	PB2	PB1	PB0	R/W	B port. Used for printer control.
FFC3		CRB7	CRB6	CRB5	CRB4	CRB3	CRB2	CRB1	CRB0	R/W	
FFC4	ACIA	IRQ	PE	OVRN	FE	CTS	DCD	TDRE	RDRF	R	Used for switching between cassette tape interface and RS-232C line interface.
		CR7	CR6	CR5	CR4	CR3	CR2	CR1	CR0	W	
FFC5		D7	D6	D5	D4	D3	D2	D1	D0	R	
		D7	D6	D5	D4	D3	D2	D1	D0	W	
FFC6	CRTC	O	O	O	A4	A3	A2	A1	A0	W	CRTC address register.
FFC7		D7	D6	D5	D4	D3	D2	D1	D0	R/W	CRTC data register.
FFC8	KBNMI	BK	X	X	X	X	X	X	X	R	BREAK key pressed when BK = "1".
FFC9	DIPSW	O	O	O	O	O	O	1	1	R	Data fix.
FFCA	TIMER	T	T2	X	X	X	X	X	X	R	Timer FIRQ generated when T = "1" (system mode B). High-speed timer FIRQ generated when T2 = "1" (system mode A).
FFCB	LPFLG	O	X	X	X	X	X	X	X	R	Fixed to data D7 = "0".
FFD0	MODE-SEL	W	HR	C	O	IB	GB	RB	BB	W	Register for status set (See (2)).
FFD1	TRACE	O	O	O	O	O	O	O	O	W	Trace counter ON during WRITE (NMI generated).
FFD2	REMOTE	RM	O	O	O	O	O	O	O	W	Relay ON when RM = "1" (cassette remote OFF).
FFD3	MUSIC-SEL	MS	O	O	O	O	O	O	O	W	Audio emitted from internal speaker (switch to and from "0" and "1").
FFD4	TIME MASK	TM	O	O	O	O	O	O	O	W	Timer FIRQ inhibited (internal clock stop) when TM = "1" in system mode B.
		O	O	O	O	O	O	TM2	T2S	W	In system mode A: Inhibits high-speed timer FIRQ when TM2 = "1" Specifies 2-ms timer when T2S = "0" Specifies 1-ms timer when T2S = "1".
FFD6	INTERACE-SEL	O	O	O	O	IS	O	O	O	W	Assigned to interlace mode when IS = "1".
FFD7	BAUD-SEL	O	O	O	O	S3	S2	S1	S0	W	Assigns the cassette baud rate (See (3)).
FFD8	C-REG-SEL	MK	X/O	IG	GC	RV	G	R	B	R/W	Color register in system mode B (See (4)).
		MK	SI	IG	GR/TX	RV	G	R	B	R/W	Color register for character screen in system mode A (See (5)).

(cont'd)

(cont'd)

Address	Name	Data Bit								R/W	Functions
		D7	D6	D5	D4	D3	D2	D1	D0		
FFD9	TRQ-SEL	IRQF	STBY	TPED	$\overline{FIND}$	C3	C2	C1	C0	R	
		IE	0	0	0	C3	C2	C1	C0	W	
FFDC	MOUSE0	IF1	TR1	SGX	X12	X11	X10	X9	X8	R	Mouse control register (See (6)).
		IE	ED	XC	YC	YSG1	YCT1	XSG1	XCT1	W	
FFDD	MOUSE1	X7	X6	X5	X4	X3	X2	X1	X0	R	
FFDE	MOUSE2	IF2	TR2	SGY	Y12	Y11	Y10	Y9	Y8	R	
		0	0	0	0	YSG2	YCT2	XSG2	XCT2	W	
FFDF	MOUSE3	Y7	Y6	Y5	Y4	Y3	Y2	Y1	Y0	R	
FFE0	KB	BM	SS	0	0	UE	SL	HR	KN	W	Keyboard mode register (See (7)).
		D7	D6	D5	D4	D3	D2	D1	D0	R	Keyboard-matrix-scan data (See (8)).
FFE1	KB-TYPE	X	X	X	X	K3	K2	K1	K0	R	Type of keyboard.
FFE2	TVSUPER	0	0	0	AD	0	HC	TD	SI	W	Control of video superimpose card.
FFE4	PSG-DATA	D7	D6	D5	D4	D3	D2	D1	D0	R/W	Sound data register (See (9)).
FFE5	PSG-COM	0	0	0	0	D3	D2	D1	D2	W	Sound command register (See (9)).
FFE8	BANK-REG	0	D6	D5	D4	D3	D2	D1	D0	W	Expanded RAM bank switching register when in system mode B (See (10)).
FFE9	IGMODREG	PAE	X	X	X	X	DT	H	V	R	IG access timing adjustment (See (10)).
		0	0	0	0	0	0	0	PM	W	Enable write into RAM for IG when PM = "1" and when in system mode B.
FFEA	IGENREG	0	0	0	0	0	PG	PR	PB	W	IG color plane selection register (See (12)).
FFEB	SYS-MODE	X	X	X	X	X	SU	2M/1M	S1/L3	R	System mode register (See (13)).
		0	0	0	0	0	0	2M/1M	0	W	
FF75	KADR-H	KA11	KA10	KA9	KA8	KA7	KA6	KA5	KA4	W	JIS Kanji upper order codes. (See (14))
	KLEFT	LD7	LD6	LD5	LD4	LD3	LD2	LD1	LD0	R	Kanji font left-half.
FF76	KADR-L	KA15	KA14	KA13	KA12	KA3	KA2	KA1	KA0	W	JIS Kanji lower order codes.
	KRIGHT	RD7	RD6	RD5	RD4	RD3	RD2	RD1	RD0	R	Kanji font right-half.

1 Functions of the PIA-BANK (SFFC0, SFFC1)

PIA-BANK is the register normally used in system mode B for switching ROM addresses $A000 ~ $EFFF between the bank and the RAM area.

Bit \ Data		"0"	"1"
D0		Select RAM in addresses 8000 ~ 9FFF	Select ROM (during power input, D0, D1, D2, D3 "1" and 8000 ~ EFFF are in write only mode
D1		Select A000 ~ BFFF	
D2		Select C000 ~ DFFF	
D3		Select E000 ~ EFFF	
D6		A000 ~ BFFF are in write only mode (cannot be read)	Specification invalid when D1 = "1"
			A000 ~ BFFF are in read/write mode when D1 = "0"
D7	By D2	C000 ~ DFFF are in wirte only mode (cannot be read)	Specification invalid when D2 = "1"
			C000 ~ DFFF are in read/write mode when D2 = "0".
	By D3	E000 ~ EFFF are in write only mode (cannot be read)	Specification invalid when D3 = "1"
			E000 ~ EFFF are in read/write mode when D3 = "0"

■ **Caution:** This register is usable after write operation for D2 = "1" in $FFC1.

2 Functions of the MODE-SEL register

The MODE-SEL register consists of 7 bits and controls screen mode, screen background color and ACIA cassette/RS-232C switching.

W	H R	Mode
0	0	40-character high-resolution
0	1	40-character normal
1	0	80-character high-resolution
1	1	80-character normal

C	Mode
0	Cassette
1	RS-232

G B	R B	B B	Background Color
0	0	0	Black
0	0	1	Blue
0	1	0	Red
0	1	1	Magenta
1	0	0	Green
1	0	1	Cyan
1	1	0	Yellow
1	1	1	White

I B	Mode
0	Background color low brightness
1	Background color high brightness

■ **Caution:** The W bit and HR bit are invalid in system mode A.

3 Functions of the BAUD-SEL register (SFFD7)

Sets the I/O baud rate for the cassette interface. This register's configuration is such that it can output 3200 baud and 4800 baud for future system expansion. However, there rates are not supported in BASIC due to restrictions of cassette recorder performance.

S3	S2	S1	S0	Baud Rate	Remarks
0	0	0	0	600BPS	FSK format: 0 : 1200Hz 1 : 2400Hz
0	0	0	1	1200BPS	
0	0	1	0	2400BPS	
0	0	1	1	300BPS	
0	1	1	0	4800BPS	FSK format: 0 : 2400Hz 1 : 4800Hz
1	0	0	1	3200BPS	Hitachi's own format

■ **Caution:** If the baud rate exceeds 2400 bps, cassette I/O may not be normal.

4 Functions of the C-REG-SEL register (SFFD8)

The C-REG-SEL register is for specifying the color of the character screen and for specifying the display status of the character and graphics screens.

The C-REG-SEL register has a 7-bit configuration and is a dual-direction register for controlling screen display. Six of the seven bits, the exception being the most significant bit, are stored in the color RAM. The IG bit (bit 5) is the control bit for enabling and inhibiting IG display. Settings of bits 0 to 4 are ignored when the IG bit is "1".

(i) Write

After data is written into the C-REG-SEL register, the contents of C-REG-SEL are stored in the color RAM simultaneous to the writing of display data into the display memory. Data written into C-REG-SEL is held until the next data write or until the display memory is read. The G, R and B bits select the color palette.

(ii) Read

If the setting of the MK bit (bit 7) is "0" when the display memory is read, color information, matching the display memory addresses that have been read, is read from the color RAM and set in the C-REG-SEL register.

(iii) Meaning of the MK bit

Display memory and program storage memory are partially superimposed and used in system mode B. If a program is read in the status in which it was stored in display memory (0400 ~ 43FF), the contents of the C-REG-SEL register will simultaneously change and the display memory color information set in C-REG-SEL up to that point will be destroyed. The MK functions in such a way that when it is set to "1", color information will be held even if the program is read.

MK	Mode
0	Write enable
1	Write inhibit

GC	Mode
0	Character
1	Graphics

RV	Mode
0	Standard
1	Inverted

IG	Display Mode
0	IG display inhibit
1	IG displayed before other modes

SI	GR/TX	Mode
0	0	Displays only the character screen
0	1	Displays only the graphics screen
1	0	Displays superimposed character and graphics screens (priority to character screen)
1	1	Displays superimposed character and graphics screens (priority to graphics screen)

(Note) Display of superimposed character and graphics screens is controlled in one-character units.

G	R	B	Palette Number
0	0	0	0
0	0	1	1
0	1	0	2
0	1	1	3
1	0	0	4
1	0	1	5
1	1	0	6
1	1	1	7

6 Functions of the mouse control registers (SFFDC, SFFDD, SFFDE, SFFDF)

The mouse control registers (MOUSE0 ~ MOUSE3) are for counting mouse movements in horizontal and vertical directions by 13-bit binary counter (0000 ~ 1FFF).

■ Read mode

IF1	Stroke of trigger button 1	(0: no, 1: yes)
TR1	Status of trigger button 1	(0: OFF, 1: ON)
SGX	Movement in horizontal direction	(0: positive, 1: negative)
X12 ~ X0	Value of horizontal direction count	
IF2	Stroke of trigger button 2	(0: no, 1: yes)
TR2	Status of trigger button 2	(0: OFF, 1: ON)
SGY	Movement in vertical direction	(0: positive, 1: negative)
Y12 ~ Y0	Value of vertical direction count	

■ Write mode

IE	Interrupt enable by trigger button	(0: inhibit, 1: enable)
ED	Trigger button edge mode	(0: ⎍⎾, 1: ⏋⎽)
XC	Increment direction of counter in horizontal direction	(0: →, 1: ←)
YC	Increment direction of counter in vertical direction	(0: ↑, 1: ↓)
YSG1	Movement in vertical direction	(0: no change, 1: positive direction)
YCT1	Vertical direction counter	(0: no change, 1: clear)
XSG1	Movement in horizontal direction	(0: no change, 1: positive direction)
XCT1	Horizontal direction counter	(0: no change, 1: clear)
YSG2	Movement in vertical direction	(0: no change, 1: negative direction)
YCT2	Vertical direction counter	(0: no change, 1: all bits "1")
XSG2	Movement in vertical direction	(0: no change, 1: negative direction)
XCT2	Vertical direction counter	(0: no change, 1: all bits "1")

7 Functions of the KB register (write mode) (SFFE0)

The KB register is used to control the keyboard during write and the lamp (LED) indicators.

BM	Mode
0	KBNMI inhibit
1	KBNMI enable

SS	Mode
0	KBIRQ inhibit
0	KBIRQ enable

SL	HR	KN	Function
0	0	0	Light LED in SHIFT mode
1	1	0	Light LED in ひらがな mode
1	0	1	Light LED in カタカナ mode
1	0	0	All LEDs OFF for keyboard use

UE	Mode
0	Counter operation enable
1	Counter operation inhibit

■ **BM bit**

This bit controls the enable/inhibit of NMI interrupt generation when the BREAK key is pressed. This bit is set to "0" in BASIC. No NMI interrupt is generated by BREAK key when BASIC is used. An NMI interrupt will be generated by BREAK key when this bit is set to "1", but a processing program is required for NMI interrupt by BREAK key when this mode is used.

The IRQ interrupt will not be generated even if the BREAK key is pressed. Consequently, the KBNMI register's bit 7 decides whether the BREAK key is pressed.

■ **SS bit**

This bit controls the enable/inhibit of IRQ interrupt generation when a key is pressed. Since this bit is normally set to "1" in BASIC and IRQ interrupt will be generated with every key pressing, the key scan code will be converted to character code and stored in the key entry buffer. (The IRQ interrupt will not be generated when the BREAK key is pressed.)

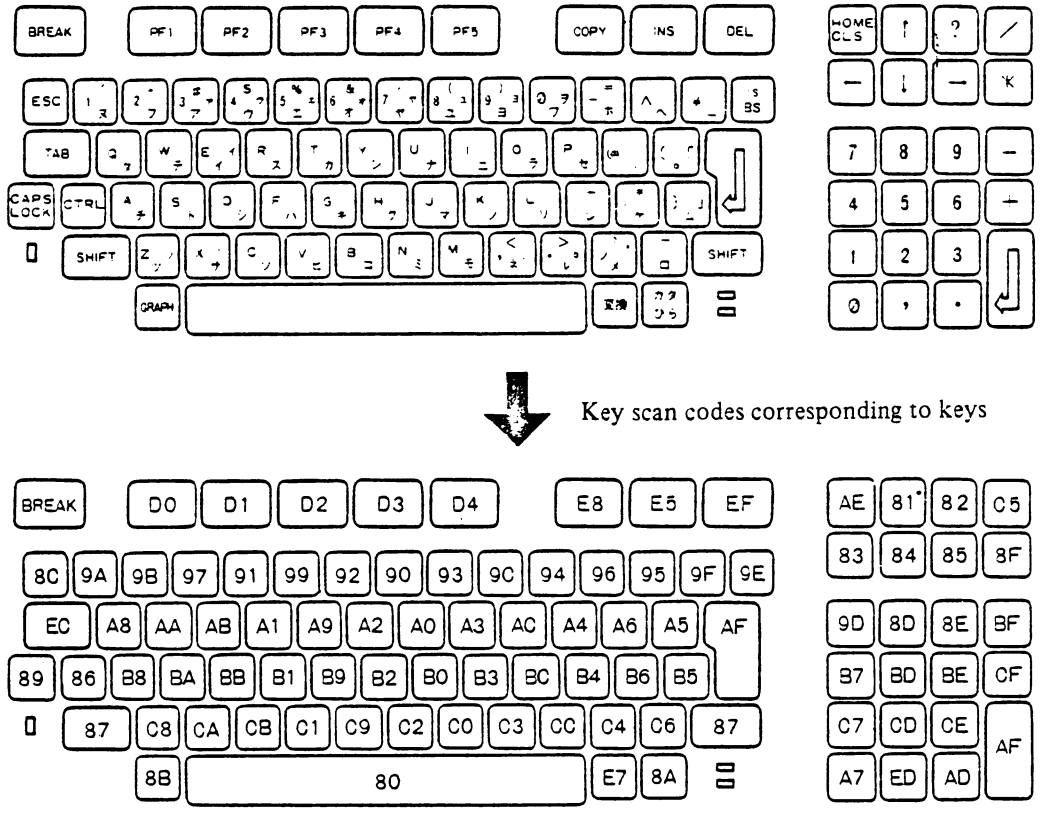
Since an IRQ interrupt will not be generated when this bit is set to "0" even if key entry is made, when key entry is necessary, it must be performed by reading the KB register. This format is not used in BASIC.

8 Functions of the KB register (read mode (SFFE0)

Keyboards generally have a matrix structure set up in such a way that a key switch goes ON or OFF when its matching key is pressed or released. For this reason, when a key has been pressed to send a command to the main unit and the pressing of that key is detected, a keyboard matrix code (key-scan code) must then be input that matches that key. To do this, the MB-S1 System uses a hardware scan method and the keyboard is controlled by the keyboard (KB) register.

In the MB-S1 System, a counter circuit constantly scans the keyboard. When a key is pressed, counter operations stop and data indicating that a key has been pressed is swept into bit 7 of the KB register and held. At the same time an IRQ interrupt is generated. The MPU reads the KB register by IRQ interrupt processing, inputs a key-scan code (the number of counts by the counter) and converts the code to the character codes shown in 11-6 "Character Code Table."

■ **Key-scan code (KB register's read mode)**



(Note) 1. Key scan codes are in hexadecimal.

2. KB register read data other than the above is invalid.

9 Functions of the PSG-DATA/PSG-COM registers

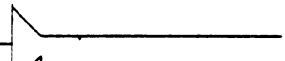
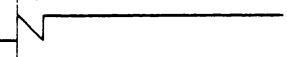
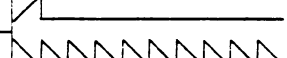
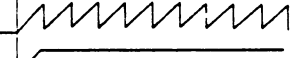
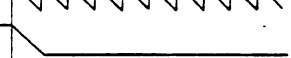
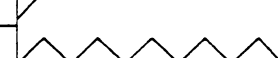
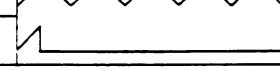
- **PSG-COM register (SFFE5)**

  The PSG-COM register uses the least significant four bits and selects the register numbers of the PSG-DATA register.

- **PSG-DATA register (SFFE4)**

Register Number	Function	Data Bits							
		D7	D6	D5	D4	D3	D2	D1	D0
0	Tone generator for channel A	Least significant 8 bits of tone data							
1						Most significant 4 bits of tone data			
2	Tone generator for channel B	Least significant 8 bits of tone data							
3						Most significant 4 bits of tone data			
4	Tone generator for channel C	Least significant 8 bits of tone data							
5						Most significant 4 bits of tone data			
6	Noise generator				5-bit noise data				
7	Noise-tone mixer			Noise			Tone		
				C	B	A	C	B	A
A	Volume of channel A (envelope operation when M = 1)				M	4-bit volume data			
B	Volume of channel B (envelope operation when M = 1)				M	4-bit volume data			
C	Volume of channel C (envelope operation when M = 1)				M	4-bit volume data			
D	Envelope period	Least significant 8 bits of envelope data							
E		Most significant 8 bits of envelope data							
F	Envelope waveforms					4-bit waveform data			

Envelope waveforms

D3	D2	D1	D0	Envelope waveform	D3	D2	D1	D0	Envelope waveform
0	0	×	×		1	0	1	1	
0	1	×	×		1	1	0	0	
1	0	0	0		1	1	0	1	
1	0	0	1		1	1	1	0	
1	0	1	0		1	1	1	1	

(Note) The period of the envelope waveform is specified in the registers numbered D and E.

10 Functions of the BANK-REG (SFFE8)

This register is valid only in system mode B.

11 Functions of the IGMODREG register (read mode) (SFFE9)

The IGMODREG register is used for IGRAM write timing (flicker prevention). The function is necessitated by the momentarily generation of flicker on the screen when IGRAM is written into during the CRTC display period.

When the IGMODREG register is read in the CRTC display period, the MPU HALTs from the end of the read to the start of the CRTC retrace line period. The MPC determines that the CRTC has entered the retrace line period by the HALT-clear when the period begins.

By reading the IGMODREG register immediately before the write into IGRAM, IGRAM is always written into during the CRTC retrace line period.

Note that the MPU will not enter HALT status and processing will continue even if the IGMODREG register is read during the CRTC retrace line period.

There is no particular need to worry about the CRTC retrace line period and character and graphics display are always read/write enabled.

12 IGENREG (SFFEA)

This register selects the RAM used to store image generator character patterns (each red, blue and green plane).

Data	PG	PR	PB
0	Green plane, no-select	Red plane, no-select	Blue plane, no-select
1	Green plane, select	Red plane, select	Blue plane, select

Data is read/write enable to each selected RAM. However, the ROM for character font storage can be read when PG = "1", PR = "1" and PG = "1".

■ **Caution:** The color palette (PALET0 ~ PALET7) controls the image generator's display color in the same way that it controls the character and graphics displays.

13 Functions of the SYS-MODE register (SFFEB)

In the MB-S1 System, clocks (operating frequencies) of 1 MHz and 2 MHz can be selected for supply to the MPU.

(1) 2-MHz clock

The 2-MHZ clock is the standard operating clock in system mode A. The MB-S1 System operates in 2 MHz except in the instances shown below when it operates with a 1-MHz clock.

(2) 1-MHz clock

When the system I/O area is accessed in the MB-S1 System, the clock is automatically set to 1 MHz in order to time the option card for BASIC-master Level 3. The clock can also be set in 1-MHz state by writing "0's" into the 2M/1M bits of the SYS-MODE register. This mode is used to run programs created for BASIC-master Level 3 at the same speed as level 3.

■ **Read mode**

S/U	Mode
0	During operations in user mode
1	During operations in system mode

2M/1M	Mode
0	During operations by 1-MHz system clock
1	During operations by 2-MHz system clock

S1/L3	Mode
0	Indicates that the mode is system mode B
1	Indicates that the mode is system mode A

■ **Write mode**

2M/1M	Mode
0	Sets system clock to 1 MHz
1	Sets system clock to 2 MHz

14 Functions of the Kanji register (SFF75, SFF76)

The Kanji register is for reading JIS standard No. 1 Kanji font from the Kanji ROM in a matrix of 16 horizontal dots by 16 vertical dots.

■ **Caution:** To use this function, the optional MPC-KA01S Kanji ROM Card will have to be installed in the MB-S1/10 Personal Computer System.

(1) Registers KADR-H ($FF75) and KADR-L ($FF76)
Specify 2-byte Kanji code.

■ **Caution:** The specified Kanji code is different from the JIS Kanji code. For further information, see the programs in (3).

KADR-H register ..... most significant bits
KADR-L register ..... least significant bits

(2) Registers KLEFT ($FF75) and KRIGHT ($FF76)
The registers for reading Kanji font.
KLEFT register ..... left half of the Kanji font.
KRIGHT register ..... right half of the Kanji font.

(3) Method of reading the Kanji font
An example of a program for reading Kanji font is given below.

Program Example

JIS Kanji code (see the BASIC Manual) is stored in the index register X (IX). The KANJRD routine given below is used to read and store one character of Kanji font in 32 bytes below KANBUF.

```
KADR—H  EQU  $FF75
KLEFT   EQU  KADR—H
KANJRD  LDA  #16
        STA  ROWCTR, PCR
        LEAU KANBUF, PCR
OUTADR  TFR  X, D
        CMPA #$30
        BHS  OUTAD1
        CMPA #$28
        BHS  OUTADO1
        CMPB #$60
        BHS  OUTADO2
        CMPB #$40
        BHS  OUTAD2
OUTAD   BSR  SUB
        BRA  OUTAD8
OUTADO1 LDX  #$3020
        BRA  OUTADR
OUTADO2 ORA  #$08
        ANDB #$BF
        BRA  OUTAD
OUTAD2  BSR  SUB
        ORB  #$20
        BRA  OUTAD8
OUTAD1  CMPA #$40
        BHS  OUTAD3
        CMPB #$40
        BHS  OUTAD4
        BSR  SUB
        ORA  #$40
        BRA  OUTAD8
OUTAD4  CMPB #$60
        BHS  OUTAD5
        BSR  SUB
        ORB  #$60
        BRA  OUTAD8
OUTAD5  BSR  SUB
        ORB  #$80
        BRA  OUTAD8
OUTAD3  CMPB #$40
        BHS  OUTAD6
        BSR  SUB
        ORB  #$A0
        BRA  OUTAD8
OUTAD6  CMPB #$60
        BHS  OUTAD7
        BSR  SUB
        ORB  #$C0
        BRA  OUTAD8
OUTAD7  BSR  SUB
        ORB  #$E0
OUTAD8  STD  KADR—H
        TFR  D, X
        LDD  KLEFT
        STD  0, U++
        DEC  ROWCTR, PCR
        BEQ  OUTAD9
        TFR  X, D
        INCB
        BRA  OUTAD8
OUTAD9  RTS
SUB     LSLB
        LSLB
        LSLB
        LSLB
        ROLA
        LSLB
        ROLA
        LSLB
        ROLA
        LSLB
        ROLA
        LSLB
        ROLA
        RORB
        RORB
        RORB
        RORB
        ANDB #$10
        RTS
ROWCTR  RMB  1
KANBUF  RMB  32
```

11-2-2 System I/O for System Mode A

Address	Name	Data Bits								R W	Functions
		D7	D6	D5	D4	D3	D2	D1	D0		
FE00	MAP 0	A19	A18	A17	A16	A15	A14	A13	A12	R W	$ 0000 ~ $ 0FFF address mapping data
FE01	MAP 1	A19	A18	A17	A16	A15	A14	A13	A12	R W	$ 1000 ~ $ 1FFF address mapping data
FE02	MAP 2	A19	A18	A17	A16	A15	A14	A13	A12	R W	$ 2000 ~ $ 2FFF address mapping data
FE03	MAP 3	A19	A18	A17	A16	A15	A14	A13	A12	R W	$ 3000 ~ $ 3FFF address mapping data
FE04	MAP 4	A19	A18	A17	A16	A15	A14	A13	A12	R W	$ 4000 ~ $ 4FFF address mapping data
FE05	MAP 5	A19	A18	A17	A16	A15	A14	A13	A12	R W	$ 5000 ~ $ 5FFF address mapping data
FE06	MAP 6	A19	A18	A17	A16	A15	A14	A13	A12	R W	$ 6000 ~ $ 6FFF address mapping data
FE07	MAP 7	A19	A18	A17	A16	A15	A14	A13	A12	R W	$ 7000 ~ $ 7FFF address mapping data
FE08	MAP 8	A19	A18	A17	A16	A15	A14	A13	A12	R W	$ 8000 ~ $ 8FFF address mapping data
FE09	MAP 9	A19	A18	A17	A16	A15	A14	A13	A12	R W	$ 9000 ~ $ 9FFF address mapping data
FE0A	MAP A	A19	A18	A17	A16	A15	A14	A13	A12	R W	$ A000 ~ $ AFFF address mapping data
FE0B	MAP B	A19	A18	A17	A16	A15	A14	A13	A12	R W	$ B000 ~ $ BFFF address mapping data
FE0C	MAP C	A19	A18	A17	A16	A15	A14	A13	A12	R W	$ C000 ~ $ CFFF address mapping data
FE0D	MAP D	A19	A18	A17	A16	A15	A14	A13	A12	R W	$ D000 ~ $ DFFF address mapping data
FE0E	MAP E	A19	A18	A17	A16	A15	A14	A13	A12	R W	$ E000 ~ $ EFFF address mapping data
FE0F	MAP F	A19	A18	A17	A16	A15	A14	A13	A12	R W	$ F000 ~ $ FFFF address mapping data
FE10	FUSE	TRON	IMK	O	O	FC3	FC2	FC1	FC0	W	System/user mode selection register (See (2))
FE18	TRAPF	TRAP	X	X	X	X	X	X	X	R	Address error graph (See (3))
FE19	BUSCTRL	BG	X	X	X	X	X	X	X	R	Bus grant
		BREQ	O	O	O	O	O	O	O	W	Bus request
FE20	BMSK-COLOR	BMSC	O	O	O	O	G	R	B	W	Graphics color specification (See (4))
FE21	ACTIVE-PLANE	O	O	O	O	DW	G	R	B	W	Graphics color specification (See (5))
FE23	DISP-PAGE	G	R	B	O	O	O	GR	TX	W	Display screen specification (See (6))
FE24	SCRN-MODE	O	O	O	O	O	D2	D1	D0	W	Screen mode specification (See (7))
FE25	B-REG	D7	D6	D5	D4	D3	D2	D1	D0	R W	Graphics color register (scroll register) (See (8))
FE26	R-REG	D7	D6	D5	D4	D3	D2	D1	D0	R W	
FE27	G-REG	D7	D6	D5	D4	D3	D2	D1	D0	R W	

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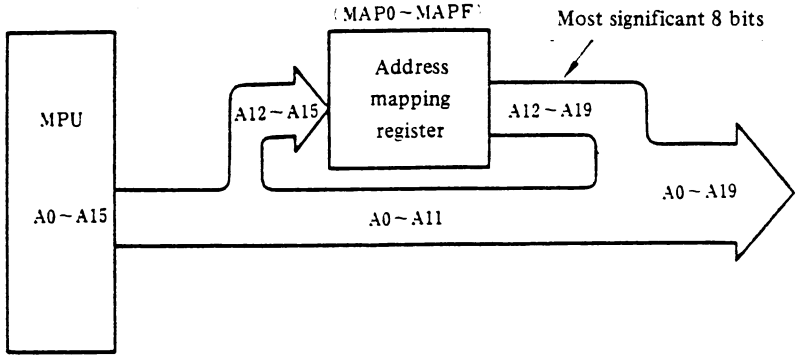
Address	Name	Data Bits								R W	Functions
		D7	D6	D5	D4	D3	D2	D1	D0		
FE28	PALET 0	O	O	O	O	I	G	R	B	W	Color palette
FE29	PALET 1	O	O	O	O	I	G	R	B	W	
FE2A	PALET 2	O	O	O	O	I	G	R	B	W	
FE2B	PALET 3	O	O	O	O	I	G	R	B	W	
FE2C	PALET 4	O	O	O	O	I	G	R	B	W	
FE2D	PALET 5	O	O	O	O	I	G	R	B	W	
FE2E	PALET 6	O	O	O	O	I	G	R	B	W	
FE2F	PALET 7	O	O	O	O	I	G	R	B	W	
FE40	PIA-A	PA7	PA6	PA5	PA4	PA3	PA2	PA1	PA0	R W	PIA HD6821 A port (See note below)
FE41		CRA7	CRA6	CRA5	CRA4	CRA3	CRA2	CRA1	CRA0	R W	

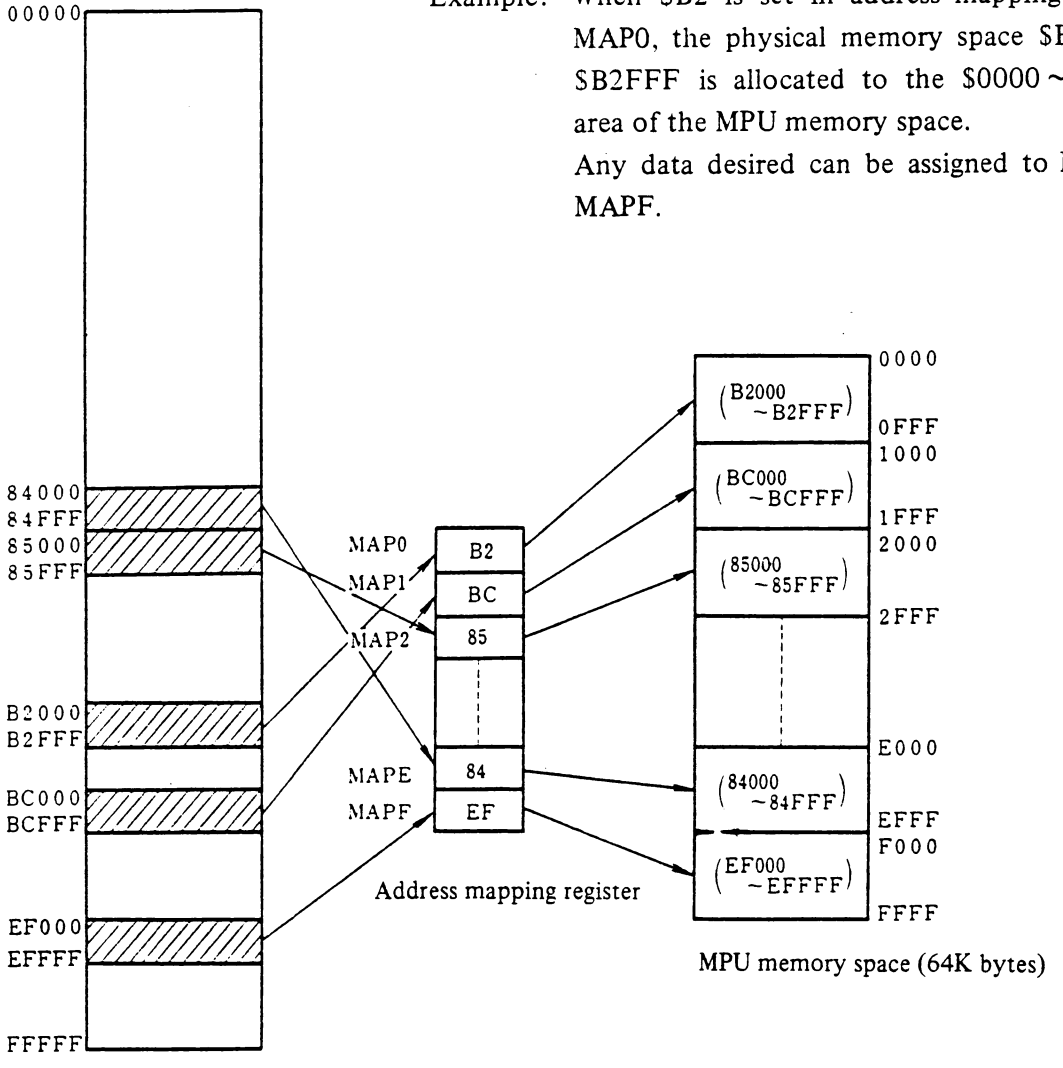
(Note) Use the PIA-A registers (FE40, FE41) after "0" has been written into D1 (2M/1M) of the SYS-MODE register (FFEB) described in 11-2-1.

1 Functions of the address mapping registers (MAP0 ~ MAPF) (SFE00 ~ SFE0F)

One megabyte of memory space is accessible in system mode A, but accessing that memory space requires a 20-bit address bus. But, only 64K bytes (MPU memory space) of that one megabyte can be directly accessed because the address bus in the 68B09E MPU is 16 bits.
For that reason, the MB-S1 System's one-megabyte memory space is divided into memory blocks of 4K bytes each and the one megabyte memory area can be accessed and used by allocating (address mapping method) the memory blocks within the MPU address area.
Specifying the most significant 8 bits (A12 ~ A19) of the 20 address bits allocates (address maps) the address mapping registers (MAP0 ~ MAPF) to each memory block's MPU memory space.



Example: When $B2 is set in address mapping register MAP0, the physical memory space $B2000 ~ $B2FFF is allocated to the $0000 ~ $0FFF area of the MPU memory space.
Any data desired can be assigned to MAP0 ~ MAPF.



Concept of Address Mapping

* As shown in (2) "Functions of the FUSE register," data assignments to MAPE and MAPF are invalid in the system mode.

2 Functions of the FUSE register (SFE10)

The FUSE register is the register for switching between system and user modes.

- **System mode**

  In the operational mode assigned by RESET and the generation of hardware and software interrupts, the physical memory space's $84000 ~ $84FFF area is assigned to MPU memory space $E000 ~ $EFFF and the physical memory space's $FE000 ~ $EFFFF area is assigned MPU memory space $F000 ~ $FFFF.

  All memory areas (physical memory spaces) are accessible in this mode.

- **User mode**

  This is the mode when the S/U bits in the SYS-MODE register are "0" and the physical memory spaces assigned to the MAPE and MAPF register for MPU memory space $E000 ~ $EFFF and $F000 ~ $FFFF become valid.

  However, the address mapping register and FUSE register cannot be accessed in this mode.

  The FUSE register's FC3 ~ FC0 bits assign the timing (number of timing cycles: 1 ~ 15 machine cycles) for moving from system mode to user mode. The system mode continues when all bits FC3 ~ FC0 are "0".

  The system mode is entered in S1 BASIC simultaneous to power ON. The assigning of "0" to FC3 ~ FC0 provides constant operations in the system mode.* (User mode not used)

  * The system mode is constant in S1 BASIC because MAPF (addresses F000 ~ FFFF) is used as the hardware register area and the ROM for storing programs for system supervision and MAPE (addresses E000 ~ EFFF) is used as the system stack.

TRON	Mode
0	Inhibits operations of the trace counter
1	Enables operations of the trace counter

IMK	Mode
0	Does not hardware mask the interrupt
1	Hardware masks the interrupt

- **IMP bit**

  Used to mask (inhibit interrupt input to the MPU) the NMI, FIRQ and IRQ hardware interrupts in one group.

3 Functions of the TRAPF register (SFE18)

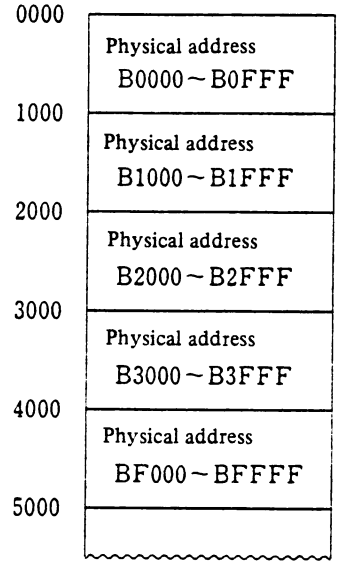
An NMI interrupt is generated when the areas of physical addresses BF000 ~ BFFFF are accessed in the MB-S1 System and the TRAPF register's TRAP bit becomes "1".
The following is an example of how the register is used.

[Example] One each B0, B1, B2 and B3 (physical addresses B0000 ~ B3FFF) is assigned to address mapping registers MAP0 to MAP3 and B4 is assigned to MAP4.
When the B000 ~ B3FFF area is 0-cleared, in the standard program,

```
                                        Number of
                                        machine cycles
        LDX     #$0000          .       3
        LDD     #$0000          .       3
LOOP    STD     0, X++          .       8
        CMPX    #$4000          .       4
        BNE     LOOP            .       3
```

requiring a total of 122,880 machine cycles.
If the TRAPF register is used.

```
                                        Number of
                                        machine cycles
        LDX     #$0000          .       3
        LDD     #$0000          .       3
LOOP    STD     0, X++          .       8
        BRA     LOOP            .       3
```



MPU memory space

* NMI is generated when address 4000 or above is accessed.

and improves processing speed by at least 25% over standard processing because processing ends in a total of 90,112 machine cycles.
(However, an NMI processing program is required.)

4 Functions of the BMSK-COLOR register (SFE20)

This is the register for specifying color when dot patterns are indirectly written into the graphics RAM (red, blue and green).

Bit	0	1
B	No specification of blue color	Write specified dots of blue color
R	No specification of red color	Write specified dots of red color
G	No specification of green color	Write specified dots of green color
BMSC	(See (9) and (10))	

5 Functions of the ACTIVE-PLANE register (SFE21)

This register is for specifying the accessed RAM (red, green or blue planes) when the red, green or blue graphics RAM is read from or written into.

Bit	0	1
B	Blue plane inaccessible	Blue plane accessible
R	Red plane inaccessible	Red plane accessible
G	Greed plane inaccessible	Green plane accessible
DW	(See (9) and (10))	

6 Functions of the DISP-PAGE register (SFE23)

Specifies the screen page to be displayed on the screen.

Bit	0	1	Conditions
TX	Character screen page 0	Character screen page 1	When in 40-character mode
GR	Graphics screen page 0	Graphics screen page 1	When in the 320 x 200 dot mode
B	No display of graphics blue plane	Displays graphics blue plane	See note below
R	No display of graphics red plane	Displays graphics red plane	
G	No display of graphics green plane	Displays graphics green plane	

(Note) The text mode is when R = "0", B = "0" and G = "0" and the graphics RAM is used to store data and programs (RAM 16K bytes x 3 = 48K bytes)

7 Functions of the SCRN-MODE register (SFE24)

Specifies the screen mode.

Bit	0	1
D0	When D1 = "0", 320 x 200 dot, 8-color mode When D1 = "1", 640 x 400 dot, single-color-mode.	When D1 = "0", 320 x 200 dot, 64-color mode When D1 = "1", 640 x 200 dot, 8-color mode
D1	Graphics – Horizontal direction 320-dot mode	Graphics – Horizontal direction 640-dot mode
D2	Character screen – 40-character x 25 line mode	Character screen – 80-character x 25-line mode

■ **Caution:**
1. The 320 x 200 dot, 64-color mode is valid when the MPC-VSC1S Video Superimposed Card and C15-B01 RGB Input TV are incorporated in the system.
2. Pronounced flicker on the display screen in the 640 x 400 dot, single-color mode.

8 Functions of the graphics color registers (SFE25, SFE26 and SFE27)

These are the graphic display's color registers (BREG = blue, R-REG = red and G-REG = green). Data is indirectly read from and written into the graphics RAM through these registers. (See (9) and (10)).

To use the graphic color registers as scroll registers the BMSK-COLOR register's BMSC bit is set to "0" and the ACTIVE-PLANE register's DM bit is set to "1". (The graphics RAM's plane that scrolls the indirect write mode and 3-system simultaneous read mode is set in the ACTIVE-PLANE register.)

When the graphics RAM is read in the above status during graphics screen scroll, data is simultaneously read from the B-REG, R-REG and G-REG registers specified by the MPU and the ACTIVE-PLANE register. If data read from the MPU is written, without modification, into addresses that are required to be scrolled (transferred), the B-REG, R-REG and G-REG register contents that match the B, R and G bits specified by the ACTIVE-PLANE register will also be written, without modification, into those addresses.

By using the color graphics registers in this way, graphics screen scroll processing that would normally have to be done three times is completed at one time.

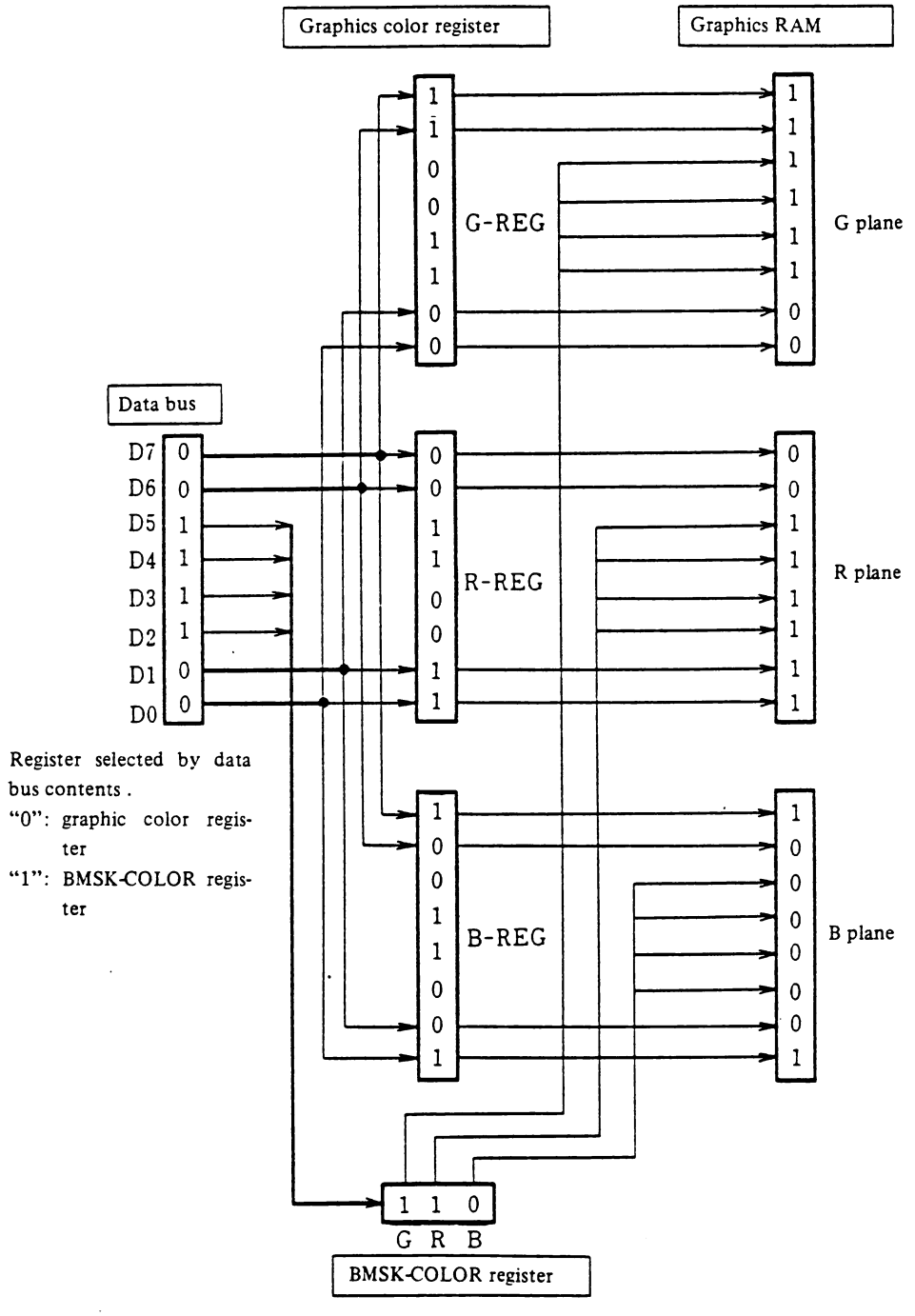
9 Writing into the graphics RAM

Three modes of direct and indirect write and read can be selected by combining the BMSK-COLOR register's BMSC bit (bit 7) and the ACTIVE-PLANE register's DW bit (bit 3) when data is written into the graphics RAM.

BMSC	DW	Mode
0	0	Directly reads data from the MPU into the graphics RAM specified by the ACTIVE-PLANE register's least significant three bits (G, R and B). However, nothing can be written into the graphics RAM if the ACTIVE-PLANE register's G, R and B bits are "0". (Direct write mode)
0	1	Writes graphics color register (B-REG, R-REG and G-REG) contents into the graphics RAM specified by the ACTIVE-PLANE register's least significant three bits. However, nothing can be written into the graphics RAM if ACTIVE-PLANE register's G, R and B bits are "0". (Indirect write mode)
1	0 or 1	Writes the data below into the graphics RAM specified by the ACTIVE-PLANE register's least significant three bits. (Bit-mask write mode) • Contents of the graphics color registers when the data bus (data from MPU) is "0". • Contents of the BMSK-COLOR registers when the data bus is "1". (See chart below)

Example of bit-mask write mode

Contents of the graphics color register or the BMSK-COLOR register are written into the graphics RAM by the contents of the data bus.



10 Read of the graphics RAM

The two modes shown below are selected by the BMSC bit and the DW bit in the same way as in (9).

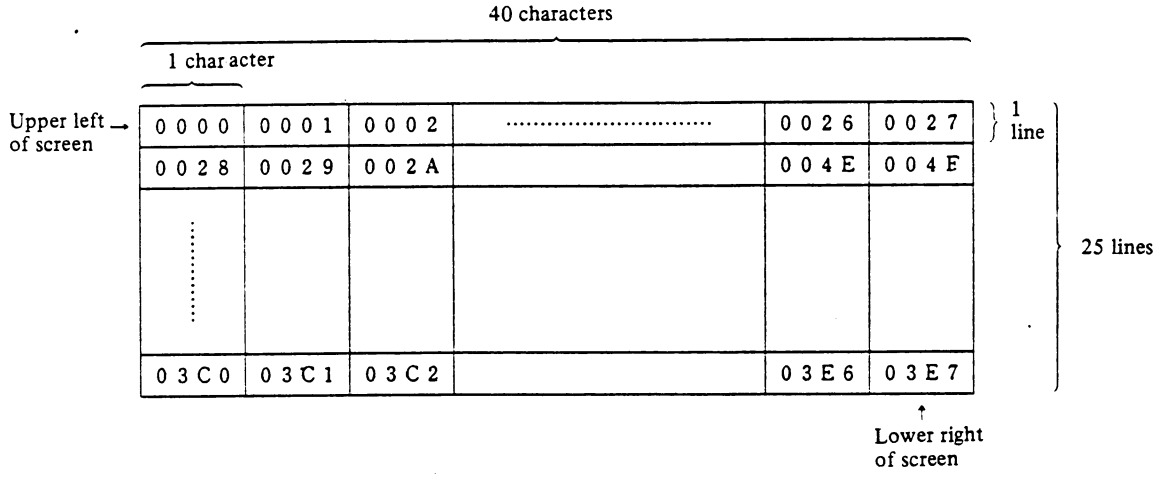
BMSC	DW	Mode
0	0	Contents of the graphic RAM specified by the ACTIVE-PLANE register are directly read into the MPU. Priority to the ACTIVE-PLANE register's least significant three bits is given at this time in the sequence, G, R, B. For example, even if both the G and the R bit are "1" data on the G plane will be read into the MPU first because the G bit has priority. (Sequential read mode)
0	1	Read the contents of the graphics RAM into the MPU in the same way as when DW = "0". However, data on the G, R or B plane specified by ACTIVE-PLANE will be simultaneously read from the graphics color registers (G-REG, R-REG and B-REG). (Three-sequence simultaneous read mode)

11-3 Display Memory and CRTC

11-3-1 Character Screen

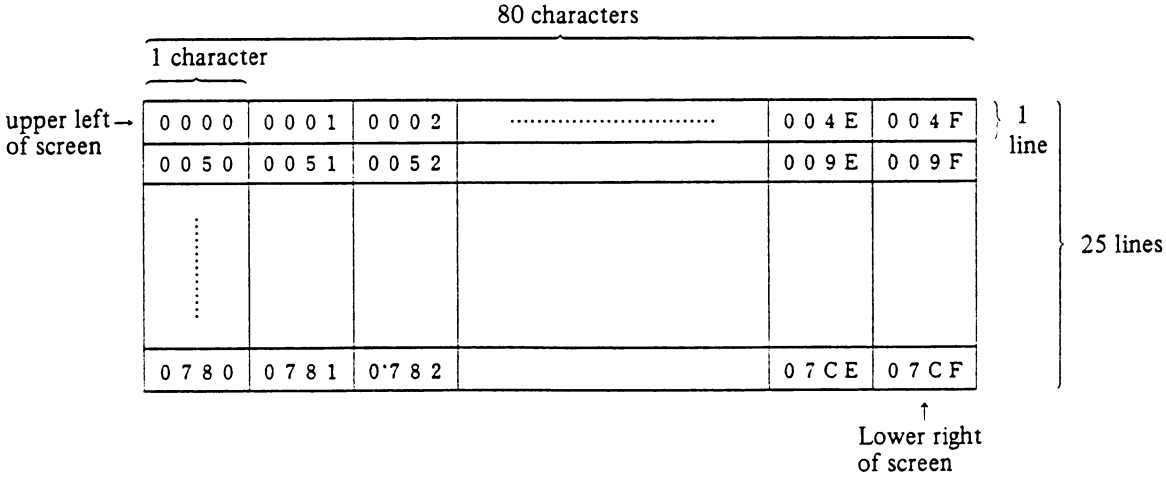
The physical address $BC000 is added to the address listed below.

■ 40-character mode



(Note) On the second page, $0400 is added to the above addresses.

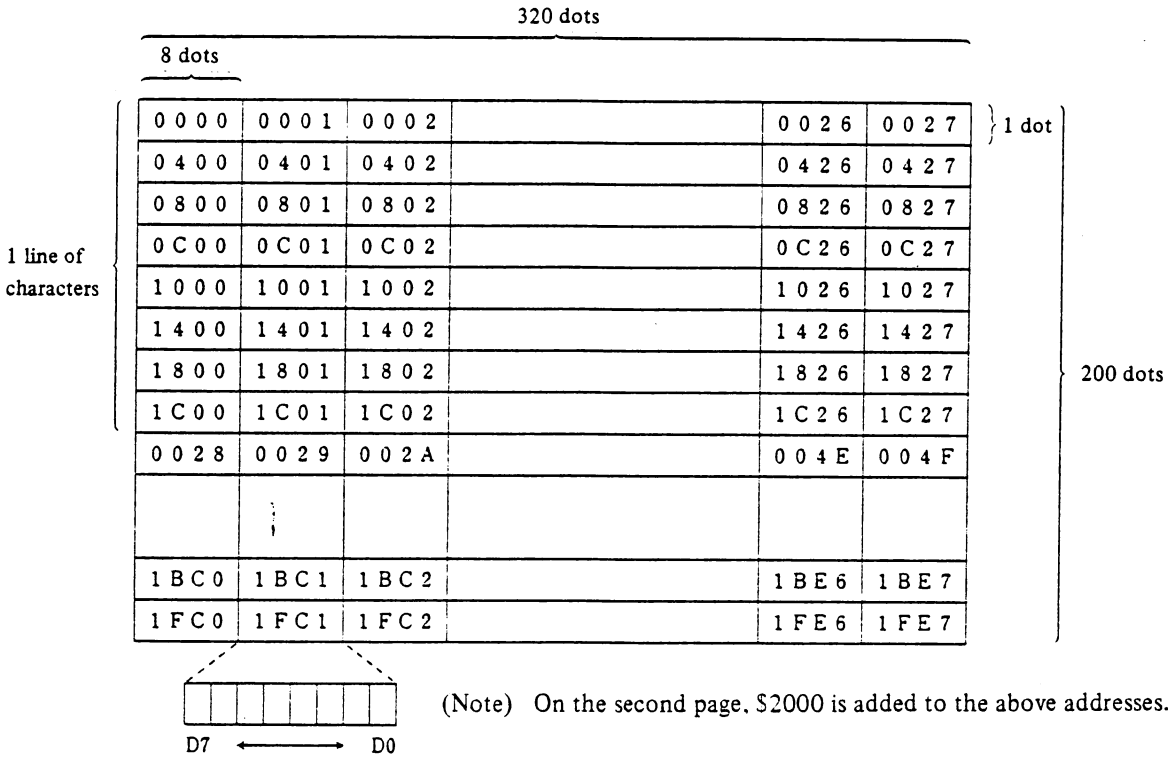
■ 80-character mode



11-3-2 Graphics Screen

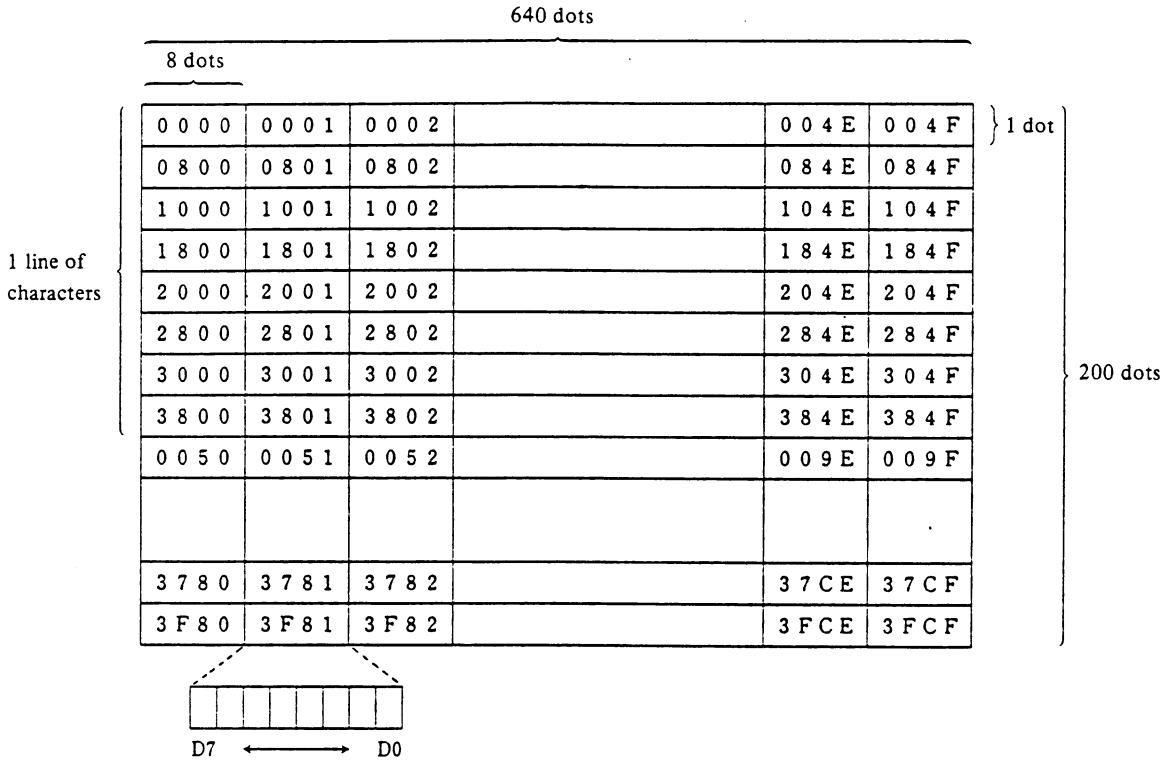
Physical address $B0000 is added to the addresses listed below.

■ 320 x 200 dot mode

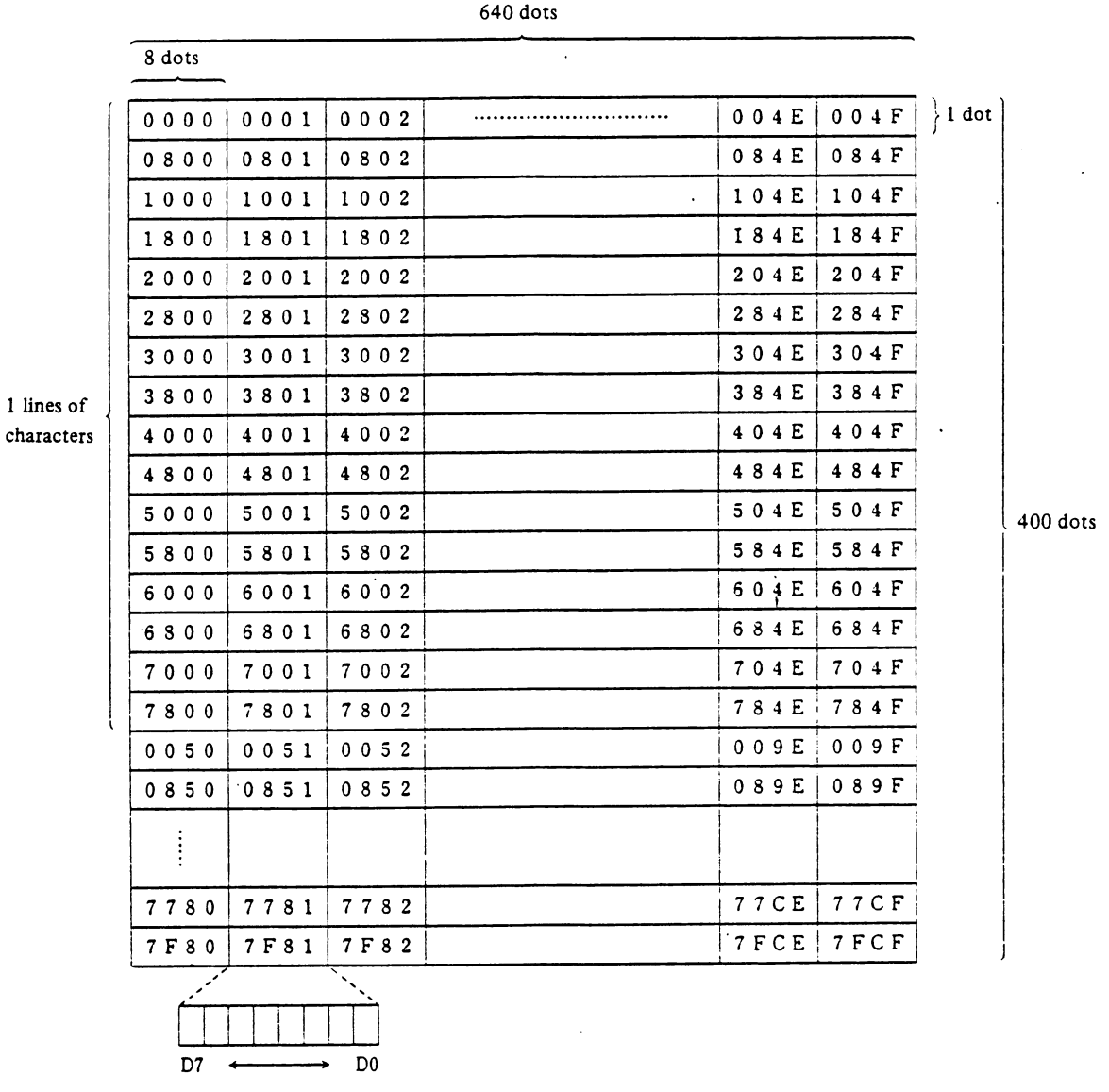


(Note) On the second page, $2000 is added to the above addresses.

■ 640 x 200 dot mode



■ 640 x 400 dot mode (interlace mode only)



11-3-3 Setting CRTC

The HD6845S is the LSI used for the CRTC (LSI for screen display) in the MB-S1 System. The CRTC control registers are initialized with the values shown in the table below.

Regist

Register Number	Register Name	Interlace	Non-interlace
R0	Number of all horizontal characters	7F	7F
R1	Number of horizontal display characters	50	50
R2	Horizontal synchronous position	5F	5F
R3	Synchronous pulse width	8A	8A
R4	Number of all vertical characters	1F	1F
R5	Total raster adjust	06	06
R6	Number of vertical display characters	19	19
R7	Vertical synchronous position	1C	1C
R8	Interlace and skew	43	40
R9	Maximum raster address	0E	07
R10	Cursor start raster	2E	27
R11	Cursor end raster	0F	07
R12	Start address (H)	00	00
R13	Start address (L)	00	00
R14	Cursor (H)	00	00
R15	Cursor (L)	00	00
R16	Light pen (H)	(Unused)	
R17	Light pen (L)		

Important Points in Setting CRTC

(1) SCRN-MODE register switches horizontal 40-character/80-character modes (not through CRTC).

(2) Cursor position (R14, R15) in the horizontal 80-character mode is specified by the byte offset address of the 80-character mode screen shown 11-3-1.

(3) Cursor position specification in the horizontal 40-character mode is a specification of double the value (1-bit shift to the left) of the offset address shown in the 40-character screen mode in 11-3-1 with the upper left screen as 0000 for both the first and second pages.

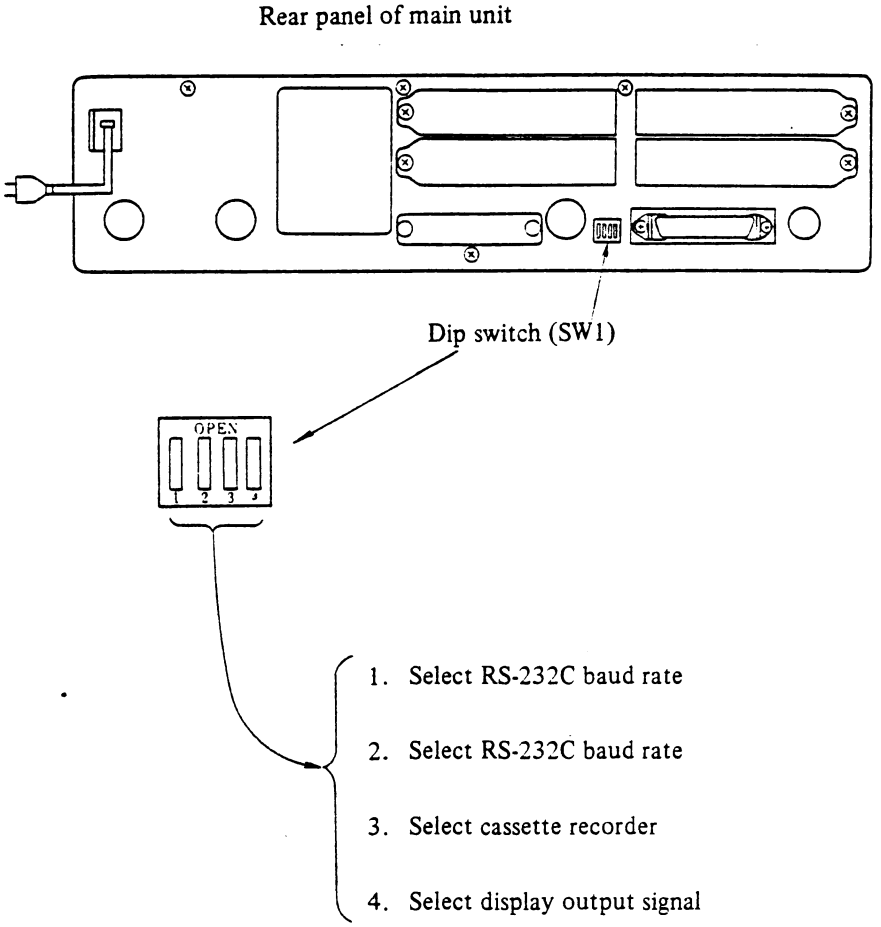
* When the cursor position is specified, 0000 is used for the upper left of the screen on the second page also.

(4) Start addresses (R12, R13) are specified as 0000 without any relation to the horizontal 80 character/40 character or first page/second page.

(5) Physical addresses are accessed when the screen is displayed (use care because this is different from the cursor specification).

11-4 Setting the Dip Switch

The functions listed below can be assigned by using the 4-pin dip switch (SW1) on the rear panel of the main unit.



See 10-2 "Setting Baud Rate" for details of how to set the two RS-232C baud rate selection switches.

(1) Setting the cassette recorder selection wwitch

If you are storing programs and data on cassette tape, you must partially change the record output signal of the MB-S1 cassette interface according to the type of cassette recorder you are using.

No.	Dip Switch Setting	Cassette Recorder	Remarks
1		TRQ-359 Cassette Recorder	
2		TRQ-1500 Data Recorder TRQ-2400 Data Recorder	Status set when shipped from the factory.

■ **Caution:** The switches are operative only during recording (write). Play (read) will be performed no matter what position the switches are in.

(2) Setting the display output signal selection switch

These switches use the screen display signal (output from the connector that connects the color display). The switches are used when special printers (printers generally available on the market) are used to provide hard copy of screen displays.

No.	Dip Switch Setting	Screen Display Signal	Remarks
1		Outputs standard display signal	Status set when shipped from the factory.
2		Outputs signals for the special printers	Since these devices will generate interference to TV and radio do not operate them close to radio or TV. If they do generate interference, operate them with power to TV or radio disconnected.

■ **Caution:** When these switches are set to position No. 2 and a color display is connected, the display will not be normal.

11-5 Keyboard Matrix Table

Least significant 4 bits \ Most significant 4 bits	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
8	SPACE	↑	!	←	↓	→	CTRL	SHIFT		CAPS LOCK	カタ ひら	GRAPH	ESC	8	9	*
9	, 7 ヤ ャ	$ 4 ウ ゥ	& 6 オ ォ	(8 ユ ュ	0 ヲ ワ	^ ヘ	= - ホ	# 3 ア ァ		% 5 エ ェ	' 1 メ	" 2 フ	) 9 ヨ ョ	7	I S B S	¥ -
A	U ナ	R ス	Y ン	I ニ	P セ	[「 。	@ ミ	0	Q タ	T カ	W テ	E イ ィ	O ラ	.	HOME CLS	↵
B	J マ	F ハ	H ク	K ノ	+ ; レ	] 」 ム	* : ケ	4	A チ	G キ	S ト	D シ	L リ	5	6	-
C	M モ	V ヒ	N ミ	< , 、 ネ	? / ・ メ	/	_ ロ	1	Z ツ ッ	B コ	X サ	C ソ	> . 。 ル	2	3	+
D	PF6 PF1	PF7 PF2	PF8 PF3	PF9 PF4	PF10 PF5											
E						INS		変換	COPY				TAB	,		DEL
F	Key-board discon-nected	JIS Key-board														

11-6 Character Code Table

(1) Interlace mode

■ **Caution:**

Character code 7F differs according to system mode.

In system mode A
(S1 BASIC)
..... DEL code

In system mode B
(LEVEL-3 BASIC)
..... " " code

→ most significant 4 bits

least significant 4 bits ↓

x / y	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0		DE		0	@	P		p	年	π	〒	ー	タ	ミ	た	み
1	SH	D1	!	1	A	Q	a	q	月	あ	。	ア	チ	ム	ち	む
2	SX	D2	"	2	B	R	b	r	日	い	「	イ	ツ	メ	つ	め
3	EX	D3	#	3	C	S	c	s	市	う	」	ウ	テ	モ	て	も
4	ET	D4	S	4	D	T	d	t	区	え	、	エ	ト	ヤ	と	や
5	EQ	NK	%	5	E	U	e	u	町	お	・	オ	ナ	ユ	な	ゆ
6	AK	SN	&	6	F	V	f	v	を	か	ヲ	カ	ニ	ヨ	に	よ
7	BL	EB	'	7	G	W	g	w	ぁ	き	ァ	キ	ヌ	ラ	ぬ	ら
8	BS	CN	(	8	H	X	h	x	ぃ	く	ィ	ク	ネ	リ	ね	り
9	HT	EM	)	9	I	Y	i	y	ぅ	け	ゥ	ケ	ノ	ル	の	る
A	LF	SB	*	:	J	Z	j	z	ぇ	こ	ェ	コ	ハ	レ	は	れ
B	HM	EC	+	;	K	[	k	{	ぉ	さ	ォ	サ	ヒ	ロ	ひ	ろ
C	CL	→	,	<	L	¥	l	|	ゃ	し	ャ	シ	フ	ワ	ふ	わ
D	CR	←	-	=	M	]	m	}	ゅ	す	ュ	ス	ヘ	ン	へ	ん
E	SO	↑	.	>	N	^	n	~	ょ	せ	ョ	セ	ホ	゛	ほ	■
F	SI	↓	/	?	O	_	o	\	っ	そ	ッ	ソ	マ	゜	ま	

(2) Non-interlace mode

■ **Caution:**

Character code 7F differs according to system mode.

In system mode A
(S1 BASIC)
..... DEL code

In system mode B
(LEVEL-3 BASIC)
..... " " code

→ most significant 4 bits

least significant 4 bits ↓

x / y	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0		DE		0	@	P		p			〒	ー	タ	ミ		
1	SH	D1	!	1	A	Q	a	q			。	ア	チ	ム		円
2	SX	D2	"	2	B	R	b	r			「	イ	ツ	メ		年
3	EX	D3	#	3	C	S	c	s			」	ウ	テ	モ		月
4	ET	D4	S	4	D	T	d	t			、	エ	ト	ヤ		日
5	EQ	NK	%	5	E	U	e	u			・	オ	ナ	ユ		時
6	AK	SN	&	6	F	V	f	v			ヲ	カ	ニ	ヨ		分
7	BL	EB	'	7	G	W	g	w			ァ	キ	ヌ	ラ		秒
8	BS	CN	(	8	H	X	h	x			ィ	ク	ネ	リ	♠	
9	HT	EM	)	9	I	Y	i	y			ゥ	ケ	ノ	ル	♥	
A	LF	SB	*	:	J	Z	j	z			ェ	コ	ハ	レ	◆	
B	HM	EC	+	;	K	[	k	{			ォ	サ	ヒ	ロ	♣	♪
C	CL	→	,	<	L	¥	l	|			ャ	シ	フ	ワ	●	÷
D	CR	←	-	=	M	]	m	}			ュ	ス	ヘ	ン	○	±
E	SO	↑	.	>	N	^	n	~			ョ	セ	ホ	゛		■
F	SI	↓	/	?	O	_	o	\			ッ	ソ	マ	゜		

Section 12. Specifications

(In order to make improvements, these specifications are subject to change without notice.)

■ MPU	68B09E	1MHz/2MHz clocks
■ ROM	24K-byte	LEVEL-3 BASIC
	64K-byte	S1 BASIC
	64K-byte	Character generator
	160K-byte	JIS Standard No. 1 ROM (optional with the MB-S2/10)
■ RAM	48K-byte	Program storage (dynamic RAM)
	48K-byte	Graphics display (dynamic RAM)
	4K-byte	Character display (static RAM)
	6K-byte	Image generator (static RAM)

■ Display

Output format

RGB synchronous signal separate format (color)

Composite video signal format (monochrome)

Character display configuration

80-character horizontal x 25-line vertical (2000 characters)

40-character horizontal x 25-line vertical (1000 characters)

Characters

281 types of character and graphics signals

Character configuration

8 x 8 dots (non-interlace)

8 x 16 dots (interlace)

Display color

15 colors (Two tones each of blue, red, magenta, green, cyan, yellow and white by luminance signal and black)

Graphics display

640 horizontal dots x 200 vertical dots

320 horizontal dots x 200 vertical dots

(640 horizontal dots x 400 vertical dots in interlace and single-color)

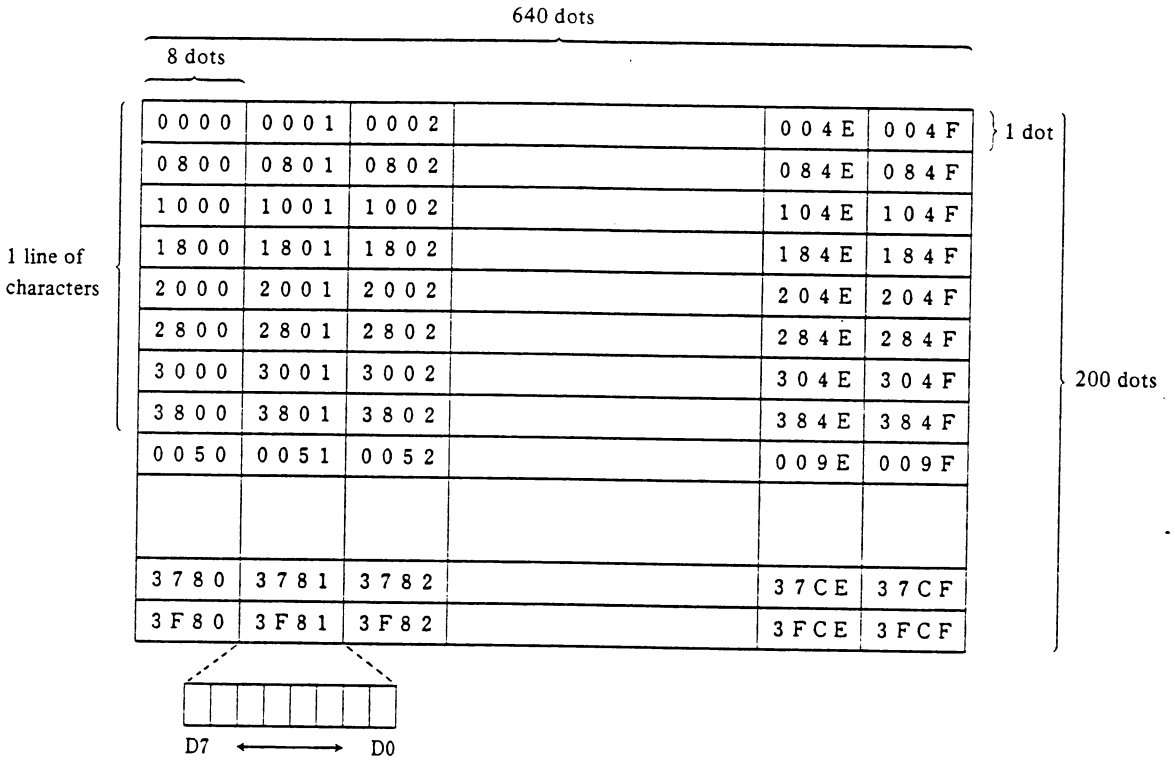
Image generator

256 types of user-defined patterns

	Screen scanning method Non-interlace mode Interlace mode Color palette Select 8 of 15 colors
■ **Keyboard**	Key array ANK keys based on JIS array 92 keys Scanning method Hardware scanning method Miscellaneous Auto-repeat and advance entry functions
■ **Cassette interface**	Transfer speeds 600, 1200 and 240 BPS Transfer method FSK method (1 start bit, 8 data bits, 2 stop bits)
■ **Line interface**	Transfer speeds 300, 600, 1200, 2400 and 4800 BPS Transfer method Based on EIA RS-232C ratings
■ **Printer interface**	Transfer method 8-bit parallel method based on Centronix specifications (handshake method by STROBE and ACK signals)
■ **Mouse interface (option)**	Hitachi's own format
■ **Sound**	3-tone, 8-octave output (volume adjustable)
■ **Interface expansion slot**	Contains 2 groups of internal interface expansion connectors Contains internal video superimpose card expansion connectors Contains 1 group of sockets for mouse interface
■ **Voltage and power**	AC 100V 50Hz/60Hz
■ **Power consumption**	15W (standard state)
■ **Environmental requirements**	Temperature range during operation 5°C to 35°C Temperature range during storage −15°C to 60°C Humidity 20% to 80% (with no moisture condensation)

External dimensions	Main unit 390 mm wide x 97 mm high x 336 mm deep Keyboard 390 mm wide x 42 mm high x 177 mm deep
Weight	4.0 kg (main unit) 1.2 kg (keyboard)

■ 640 x 200 dot mode

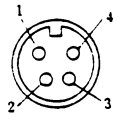


2. Monochrome display connector (B/W)

(1) Signal specifications

Composite video signal output.

(2) Connector pin locations



B/W
(4-pin DIN connector)

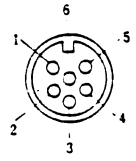
Data Direction (Unit —— Ext.)	Signal name	Pin No.	Pin No.	Signal name	Data Direction (Unit ⟷ Ext.)
	——	1	2	GND	⟷
⟶	VIDEO	3	4	——	

3. Cassette Recorder Connector (CASSETTE)

(1) Signal specifications

Hitachi format

(2) Connector pin locations



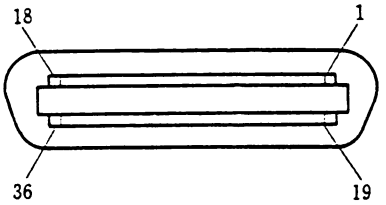
Data Direction (Unit ⟷ Ext.)	Signal name	Pin No.	Pin No.	Signal name	Data Direction (Unit ⟷ Ext.)
⟶	REMOTE	1	2	GND	⟷
⟶	OUT	3	4	REMOTE	⟶
⟵	IN	5	6	——	

4. Printer Connector (PRINTER)

(1) Signal specifications

8-bit parallel method based on Centronix specifications.

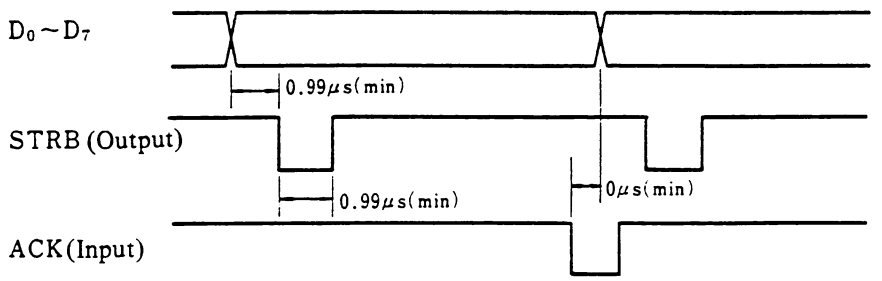
(2) Connector pin locations



PRINTER
(36-pin connector)

Data Direction (Unit ⟷ Ext.)	Signal name	Pin No.	Pin No.	Signal name	Data Direction (Unit ⟷ Ext.)
→	STRB	1	2	D_0	→
→	D_1	3	4	D_2	→
→	D_3	5	6	D_4	→
→	D_5	7	8	D_6	→
→	D_7	9	10	ACK	←
	—	11	12	—	
	—	13	14	—	
	—	15	16	GND	→
	—	17	18	—	
	—	19	20	—	
	—	21	22	—	
	—	23	24	—	
	—	25	26	—	
	—	27	28	—	
	—	29	30	—	
	—	31	32	—	
⟷	GND	33	34	—	
	—	35	36	—	

(3) Signal timing specifications

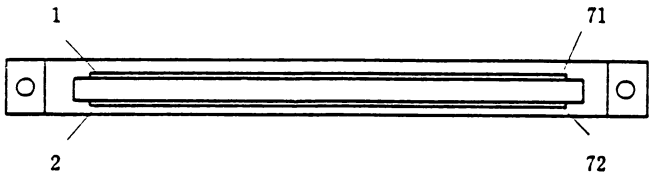


5. Interface Expansion Connector

(1) Signal specifications

Hitachi format

(2) Connector pin locations



Data Direction (Unit ⟷ Ext.)	Signal name	Pin No.	Pin No.	Signal name	Data Direction (Unit ⟷ Ext.)
→	+ 5 V	1	2	GND	←
⟷	D_0	3	4	D_1	⟷
⟷	D_2	5	6	D_3	⟷
⟷	D_4	7	8	D_5	⟷
⟷	D_6	9	10	D_7	⟷
→	A_0	11	12	A_1	→
→	A_2	13	14	A_3	→
→	A_4	15	16	A_5	→
→	A_6	17	18	A_7	→
→	A_8	19	20	A_9	→
→	A_{10}	21	22	A_{11}	→
→	A_{12}	23	24	A_{13}	→
→	A_{14}	25	26	A_{15}	→
→	BA	27	28	BS	→
←	ROM-KIL	29	30	EXROM-KIL	→
←	R/W IN	31	32	EX-I/O	→
→	R/W OUT	33	34	VMA OUT	→
→	E	35	36	Q	→
→	RES	37	38	NMI	←
←	IRQ	39	40	FIRQ	←
←	HALT	41	42	VMA CTRL	←
←	DMA	43	44	TMG2	→
→	HALT ACK	45	46	SOUND IN	←
→	16MCK	47	48	GND	⟷
→	2MCK	49	50	GND	⟷
—	—	51	52	EX-I/O2	→
→	−12V	53	54	+12V	→
⟷	GND	55	56	+ 5 V	→
→	A_{16}	57	58	A_{17}	→
→	A_{18}	59	60	A_{19}	→
→	RAMO	61	62	MPUE	→
→	RAS	63	64	CAS	→
→	REF	65	66	RASCAS	→
←	INT REF KIL	67	68	SO IF SEL	←
→	WAIT	69	70	MBC	←
→	BREQ OUT	71	72	BG IN	←

Appendix B – PF Key Sheet

Cut this template out on the dotted lines and attach to the PF key section of the keyboard.